The Way People Lie in Markets: Detectable vs. Deniable Lies*

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Abstract

In a finitely repeated game with asymmetric information, we experimentally study how individuals adapt the nature of their lies when settings allow for reputation and/or competition. While some lies can be detected *ex post* by the uninformed party, others remain deniable. We find that traditional market mechanisms, especially reputation, generate strong changes in the way people lie and lead to strategies in which individuals can maintain plausible deniability: people simply hide their lies better by substituting deniable lies for detectable lies. Although competition between players in the role of project managers increases investors' earnings when reputation is present, our results highlight the limitations of traditional market mechanisms to root out fraud when a Deniable Lie strategy is available.

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JEL: C91, D01, G41, M21

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1 Introduction

"Capitalism is based on self-interest and self-esteem; it holds integrity and trustworthiness as cardinal virtues and makes them pay off in the marketplace, thus demanding that men survive by means of virtue, not vices." This quote from A. Greenspan (1967) highlights a central tenet of an economic system based on free trade: trust and honesty in transactions. Trust and honesty are fundamental in financial markets where investors have to rely on the ethics of banks and financial advisers that benefit from private information about the expected returns of investments (*e.g.*, Guiso et al. (2008); Gennaioli et al. (2015); Gurun et al. (2018); Zingales (2015)). In fact, such reliance is widespread: Hung et al. (2008) estimate that 73% of investors consult a financial adviser before buying shares, and Egan et al. (2019) indicate that 56% of American households ask financial professionals for advice.

Yet, financial misconduct is not rare, even when there is a fiduciary duty towards investors. In financial markets fraud takes the form of dishonest schemes, promises of unrealistic returns, book cooking or favoritism (*e.g.*, Cooper and Frank (2005); Mullainathan et al. (2012); Piskorski et al. (2015); Brown and Minor (2016); Pool et al. (2016); Anagol et al. (2017)). After building a large dataset of financial advisers in the United States from 2005 to 2015, Egan et al. (2019) found that about seven percent of advisers have misconduct records, and this percentage goes up to 15 percent at some of the largest advisory companies. Moreover, about a quarter of individuals who have misconduct records are repeat offenders. In short, fraudulent behavior is a pervasive feature of the industry.[1] This misconduct is costly: Grasshoff et al. (2017) estimate that the penalties and legal costs from misconduct cases inflicted to banks represent about USD 321 billion since 2008.[2] The cost of scandals for investors, as a result of direct or indirect investment losses, is also fairly large.[3]

Frauds are frequent not only because of their expected financial return, but also because they are detectable only to varying degrees. Some will almost surely be detected, for example the creation of fake bank accounts, as in the 2018 Wells Fargo scandal, or Ponzi schemes like in the 2008 Madoff scam. But others are deniable, for example inflated earnings announcements by companies (Roychowdhury, 2006; Beyer et al., 2010), or a purposeful increase in the complexity of financial disclosures (Zhe Jin et al., 2018). Financial scandals have occurred in companies benefiting from a high reputation and in a highly competitive

[1] For experimental evidence see also *e.g.*, Cohn et al. (2014); Gibson et al. (2017)).

[2] See also the report on misconduct risks in the financial sector by the Financial Stability Board to the G20 leaders (FinancialStabilityBoard (2017)).

[3] For example, in the Madoff scandal, the size of direct wealth losses was estimated around $17 billion but Gurun et al. (2018) estimated that the reduction in investment due to the trust shock was around $430 billion, implying that the losses of direct victims have represented less than 4% of the liquidation of risky assets. Graham et al. (2002) evaluate the impact of financial scandals on the economy. They estimate that the Enron and subsequent accounting scandals led to a reduction of the U.S. GDP between 0.2 and 0.5% over a one-year period and between 1.05 and 2.5% over ten years.

context (*e.g.*, Enron, Lehman Brothers, WorldCom, Deutsche Bank).[4] This is surprising since losing reputation entails large costs and competition is expected to resolve the conflict of interest between sellers and customers by reducing gains from lying (*e.g.*, Bolton et al. (2007)). One may suspect that reputation and competition affect not only the likelihood of misconduct but also the nature of lies through their degree of detectability or deniability.

In this paper we experimentally study the *nature* of lies by players in the role of project managers, and evaluate how the introduction of reputation and competition affects the kinds and frequency of lies in dynamic settings.[5] We are the first to propose a deception game that allows players to endogenously select the type of lies they make, from detectable to deniable, and study how these choices are affected by the market institutions in place. We identify a *"Deniable Lie"* strategy that maintains plausible deniability, and show that this strategy responds to variations in market institutions.[6] In our setting, project managers are privately informed about the quality of their financial products, and have to attract uninformed investors to invest with them, which gives them an incentive to exaggerate the announced expected returns of investment. Investors have some chance of discovering fraudulent announcements *ex post*, which depends on the nature of these lies. Indeed, the market itself delivers *ex post* transparent information about the actual return of projects. Thus, lies become identifiable when realized outcomes are incompatible with the announcements. But in other cases, realized outcomes do not contradict the announcements, making lies *deniable*. The consequences of being identified may differ depending on whether the interaction is one-shot *vs.* repeated, as reputation may allow investors to punish detected liars but may not be so effective in discouraging deniable lies. Also, if there is a multiplicity of projects managers, competition may give more punishment opportunities to investors who can fire their current manager after a detected lie. How do people lie in markets? Does the introduction of reputation-building and/or competition decreases all types of lies? Or do the various market mechanisms simply change *how* project managers lie, and make them shift from detectable to deniable lies?

Involving 579 subjects in total, our laboratory experiment uses a finitely repeated Investment Game with asymmetric information in which project managers announce the likely return of their funds to investors. More precisely, the project manager receives three cards that represent a portfolio of projects. Each card has an independent 0.5 probability of

[4] Shirley (2020) further shows that many institutions are repeat offenders with multiple criminal charges.

[5] In our study, we follow Sobel's definition of a lie as "a statement that the speaker believes is false", which differs from deception in that it does not request a model of the liar's intention or of how the audience will interpret the statement (Sobel, 2020).

[6] There is a theoretical literature manipulating the detectability of lies in sender-receiver games (*e.g.,* Dziuda and Salas (2018); Balbuzanov (2019)). But while in these models detectability depends on an exogenous communication technology, in our study it is endogenous and depends on the sender's strategy.

displaying a star, indicating a successful project. The number of cards displaying a star is the project manager's private information. The project manager makes a cheap-talk announcement to the investor on his number of stars. After observing the announcement, the investor decides whether or not to invest his endowment with the project manager. Finally, Nature draws one of the project manager's three cards. Both players see the face of the card Nature draws. Whether or not there is a star on the drawn card determines the success or failure of the investment. Thus, it is mutually profitable for the project manager and the investor if he invests when the state of nature is good, but interests are not aligned when the state is bad (there are "few" or no stars among the three cards).

The message space of project managers, richer than a dichotomous "invest / do not invest" message space, allows us to identify four types of lies. **"Extreme"** lies lead to outcomes inconsistent with the announcement: reporting three stars when the truth is zero. These lies are detected *ex post* with certainty. **"High Risk"** and **"Low(er) Risk"** lies lead to outcomes that can be inconsistent with the announcement, for example reporting three stars when the truth is one or two. These lies are detected ex-post with a high (67.7%) and low(er) (33.3%) probability, respectively. **"Deniable"** lies lead to outcomes that are always consistent with the announcement, for example reporting two stars when the truth is zero or one. These lies can never be detected since both a blank card and a card with a star are consistent with a 2-star announcement, allowing the project manager to maintain plausible deniability. Thus, our design allows the project manager to modulate the "intensity" of the lie he can tell. It also allows us to characterize a Deniable Lie strategy as one in which project managers announce three stars when this corresponds to the truth and make deniable lies otherwise. Note that our parameters are chosen so that from the standpoint of project managers, the monetary incentive to misreport the truth should exceed the intrinsic moral cost of lying, as we focus on how the nature of lies (detectable *vs.* deniable) evolves depending on the market structure.

We compare behavior across four main treatments. In the **"Random Pairs"** (baseline) treatment, at the beginning of a new period each project manager is randomly rematched with an investor. In this setting, there is no competition and no possibility of reputation building with a given investor. In the **"Fixed Pairs"** treatment, pairs remain fixed throughout the session. This setting allows project managers to build a reputation (understood in our setting as fixed matching) with their investor. It also allows investors to update their beliefs regarding the honesty of their project manager. In equilibrium, truth-telling is not more likely with reputation than without it, but behavioral conjectures predict that project managers may react to the threat of direct punishment by investors. The **"Random Triplets"** treatment introduces a two-stage three-player game to figure competition: each investor is matched with two project managers who compete to attract the investor's money, as the investor can only invest with one of them. Importantly, each project manager has his own portfolio, only knows the expected return of his own portfolio, and communication with the investor is simultaneous. Finally, in the **"Fixed Triplets"** treatment, triplets remain fixed throughout the session, allowing for both reputation and competition. In this treatment, an equilibrium in which truth-telling occurs early in the game can be supported. The four main treatments allow us to not only explore the impact of various market mechanisms (*e.g.*, competition, reputation and their interaction) on the frequency and type of lies, but they also allow us to examine what motivates the different types of lies individuals make.

Our results show evidence of widespread dishonesty: over 92% of subjects lie at least once. Regarding the nature of lies, absent reputation, up to 97% of subjects who lie make lies that can lead to detection. However, the introduction of reputation leads to a major change in the nature of lies: detectable lies become infrequent, and project managers shift towards a Deniable Lie strategy, a strategy that maintains plausible deniability, so as to not be detected as liars by the investors with whom they are in fixed relationships. Indeed, when in fixed matches, investors frequently punish project managers who are caught lying by not investing with them in future periods. The reactions of investors lead reputation mechanisms to practically eliminate Extreme and High Risk lies and reduce the relative frequency of Low(er) Risk lies. However, it has no discernible effect on the frequency of Deniable lies, which can only be detected probabilistically, after a large number of interactions under various states of Nature, and are therefore much harder to punish. Thus, reputation does not necessarily make project managers more honest in all situations, but instead leads them to change the nature of their lies so as to lower their likelihood of being identified as liars when they are in fixed relationships with the investor. Such a Deniable Lie strategy is, in contrast, seldom used in the Random treatments.

The role of competition is more subtle. Competition does not reduce the frequency of lies, even in the Fixed Triplets treatment where early truth-telling is part of an equilibrium. In fact competition may even increase lies. However, when reputation is present competition does allow investors to increase their earnings significantly. This is both because there is an additional chance of making a high return investment due to the two portfolios instead of one, and because there is an additional degree of freedom when it comes to punishment in the Fixed Triplets treatment compared with the Fixed Pairs treatment. In the latter, the only way investors can punish identified liars is by exiting the market, which, in expectation, also hurts the investor. In contrast, in the Fixed Triplets treatment investors can also choose to stay in the market but switch to investing with the competitor. This results in a higher level of investment in this treatment. Nevertheless, in all treatments, investor earnings are far below what they would be if markets were transparent.

After showing strong evidence that higher earnings for themselves are a strong motivator for project managers' lying behavior, we examine what other motivations project managers may have when they make false announcements. Although exaggerated announcements could in theory help risk averse people invest in situations where they should, the analysis of strategies and earnings only partially supports the paternalistic view according to which project managers lie to the benefit of investors (this motivation may apply to no more than 15% of liars).[7] Using data from additional tasks, we also reject the view that lying behavior is driven by concerns for efficiency, or a high score in manipulativeness. Instead, the nature of lies responds to the institutions in place, which delivers clear policy recommendations.

We also conducted two other treatments that deliver two additional results. First, we show that despite the high frequency of lying, communication yields higher returns for investors than a market in which project managers cannot send any messages. This is because in some cases signals are informative, which allows investors to make "better" decisions than when no signal is sent at all. Second, we show that our conclusions are robust to the introduction of an indefinite time horizon in the game. That our results also hold in an indefinitely repeated setting shows that they are not due to the finiteness of our main treatments. This also demonstrates that reputational concerns, whether or not in combination with competition, are not strong enough to police markets, even when truth-telling is supported in equilibrium. Consequently, our findings have crucial implications for increasing trust-building. They highlight the importance of reinforcing reputation mechanisms, as well as the need for more severe audit regulations and increased personal responsibility of advisers in order to limit the prevalence of deniable lies.

The remainder of the paper is as follows. Section 2 details our contributions to the literature. Section 3 describes our experiment. Section 4 introduces our main hypotheses. Section 5 analyzes the data and presents several robustness tests. Finally, in Section 6 we conclude and discuss our results in the context of financial markets outside the laboratory.

2 Contributions to the Literature

Our paper falls within the literature on how individuals report private signals in asymmetric information settings. We are the first to propose a deception game that allows players to

[7] In a separate context, Ambuehl et al. (2019) show that paternalistic motivations can explain behavior. However, paternalism there is defined as imposing one's own preferences on others, while here its definition does not require the mapping of one's own preferences: it is having others' best financial interests at heart. In a preliminary part we elicited project managers' preferences in the role of investors by means of a Simplified Investor Game. We found that their preferences match those of the investors in the main game- few invest when a low number of stars is announced. Thus, a different set of preferences between project managers and investors cannot explain inflated announcements to convince risk averse investors to invest.

endogenously select the type of lies they make, from detectable to deniable, and study how these choices are affected by the market institutions in place in a dynamic setting. Our paper's strongest implications are thus in the literature on lying in markets and on how market mechanisms affect the honesty of transactions.

There is a large literature on individual reporting of private signals in asymmetric information games that spans both individual decision-making settings (cheating games) and games in which players interact (deception games). In contrast to our study, the recent focus of this literature has been on the identification of the intrinsic (moral) costs of deception and lying, and on whether individuals have a preference for honesty *per se*, using most of time static games. Indeed, the main empirical results of cheating games are that even when there are no scrutiny, no negative externalities to lying and lies are profitable, not all individuals lie, most liars do not lie in full, and the size of lies does not increase with the level of incentives (see the meta-analysis of Abeler et al. (2019) and the references therein). Likewise, in deception games with strategic information transmission *à la* Crawford and Sobel (1982), although lying is usually more substantial than in cheating games and is an equilibrium prediction, subjects often tell the truth.[8] In contrast with cheating games, however, raising the level of incentives increases the likelihood of lies (Gneezy, 2005; Sutter, 2009; Erat and Gneezy, 2012). The main models put forward to explain these patterns are that (1) a fraction of people suffer from lying aversion because of an intrinsic preference for truth-telling;[9] and (2) people care about how others think of them: they may suffer from perceived cheating aversion, reputational costs of lying or guilt aversion.[10]

Our objective is not to study intrinsic preferences for honesty. Instead, the parameters of our game are specifically selected so that the psychological costs of lying, whether they are due to an intrinsic preference for honesty or to image concerns, are likely compensated by the monetary incentives.[11] This allows us to focus on various lying strategies characterized by different levels of *ex ante* and *ex post* detectability and deniability across various market structures.[12] Because we allow for a wider breadth of lies, our work identifies a Deniable

[8] *E.g.*, Austen-Smith (1993); Blume et al. (1998); Krishna and Morgan (2001); Battaglini (2002); Gneezy (2005); McGee and Yang (2013); Vespa and Wilson (2016); Rantakari (2016); Li et al. (2016); Schmidbauer (2017); Ederer and Fehr (2017). This does not imply that truth-telling is the norm, see Wilson and Vespa (2020), for example. For a recent survey on strategic transmission, see Blume et al. (2020).

[9] *E.g.*, Ellingsen and Johanesson (2004); Mazar et al. (2008); Vanberg (2008); Hurkens and Kartik (2009); Shalvi et al. (2011); Fischbacher and Föllmi-Heusi (2013).

[10] See, for example, Charness and Dufwenberg (2006); Kajackaite and Gneezy (2017); Dufwenberg and Dufwenberg (2018); Gneezy et al. (2018); Abeler et al. (2019); Khalmetski and Sliwka (2019).

[11] With this choice we believe that we parallel the world outside the laboratory, where the gains from misconduct may be considerably larger than the intrinsic cost of engaging in such behavior. Further, as Egan et al. (2019) show, individuals who get caught, are often simply re-hired by other firms, meaning that the negative consequences of being caught are not as high as one may think.

[12] Previous studies have shown that there are more lies when communication is through malleable or vague messages (Serra-Garcia et al., 2011) because lying costs are lower (see Turmunkh et al. (2019) with *ex post* verifiability). Also, introducing punishment for lying does not increase truth-telling when mes-

Lie strategy and shows that individuals adapt their lying to the market environment they face. What determines the frequency, size and nature of lies is whether or not there are material consequences to being caught in a lie. It is only when project managers are in fixed matches with investors who punish detected liars that they refrain from making detectable lies. The majority of subjects show little concern about being exposed as a liar if they can avoid the direct negative consequences of such behavior. In short, because our design provides relatively high monetary incentives and varies the deniability of lies, we suggest that the way market institutions affect extrinsic motivation constitutes the primary force behind the decision to change the nature of one's lies. [13]

Our design also allows us to bring important nuances to the study of how market mechanisms can bring more honesty when information is asymmetric. The literature on credence goods, in which customers also suffer from asymmetric information, has shown that among market mechanisms (reputation, verifiability, liability, competition and the interaction thereamong), only liability (the obligation for the seller to provide a good of sufficient quality) leads to significantly more honesty.[14] Considering instead experience goods and a trust game, Huck et al. (2012) identifies the joint role of identifiability and competition in the management of moral hazard: as long as trustors can identify trustees, competition among trustees is sufficient to achieve almost full efficiency, while adding reputation through the full history of play offers no improvement. Using a sender-receiver game with psychological costs for lying, Agranov et al. (2020) show that introducing competition between independent sellers leads to more lying (a result in line with ours), due to the wrong belief of the buyers who tend to increase their trust in sellers who have to compete.

Lacking from these studies is the ability of the informed party to modulate how they lie. We show that when the set of lies is richer, as is even more the case outside the laboratory, market mechanisms such as reputation and competition may fail to root out fraud: individuals adapt the nature of their lies. While it is reassuring that reputation

sages are evasive -pretending not to know- (Khalmetski et al., 2017) (see also Sanchez-Pages and Vorsatz (2009)). In contrast here, there is no way to conceal announcements, messages are precise announcements and detectability is varied.

[13]This also explains that "how much to lie" depends on whether there are costly consequences to getting caught, more than on the distance between the true state of the world and the reported outcome. The literature has discussed the size of lies in the absence of punishment, showing that partial lies are more frequent when lying is detectable by the experimenter. In Mazar et al. (2008) and Fischbacher and Föllmi-Heusi (2013) the marginal cost of lying is increasing, whereas others reject the convexity of the intrinsic lying cost (Kartik, 2009; Kajackaite and Gneezy, 2017). We allow for equal sizes of lies to have different probabilities of detection. Lies in which project managers go from seeing 1 star to announcing 3 (lies of magnitude 2), which are detectable with a 66% chance, happen more frequently in the absence of reputation than in its presence. Lies in which they go from seeing 0 stars to announcing 2 stars (also lies of magnitude 2), which cannot be detected, are not affected by the market structure. Deniable lies are uniform across treatments while detectable lies are not, even if the "size of the lie" in its outcome dimension is identical.

[14]See Emons (1997); Charness and Garoupa (2000); Bohnet et al. (2005); Dulleck et al. (2011); Balafoutas et al. (2013); Beck et al. (2014); Mimra et al. (2016); Rasch and Waibel (2018); Feltovich (2019).

mechanisms do eliminate one type of fraud (the type for which the informed party is very likely to be exposed) even in a context in which truth-telling cannot be supported, we show that fraudulent announcements persist when they are deniable. By nature, these lies are exactly those that are difficult to identify by uninformed parties (and also by empirical studies in the field), and lead to large negative consequences for them.

3 Design and Procedures

3.1 Design

3.1.1 The Investment Game

In order to study the way people lie in markets, we propose a new game, the Investment Game, in which lying is an equilibrium outcome in a "standard" model, and further choose parameters with the objective that the possible intrinsic costs of lying are outweighed by the monetary gains from being dishonest. We then design four treatments in which we systematically turn reputation and competition on and off to explore how market mechanisms impact behavior.

The Investment Game has a finite, but unknown, horizon. Subjects are informed that they will play this game for a minimum of 20 and a maximum of 40 periods. We introduced such uncertainty to avoid end game effects.[15] The actual number of periods was actually fixed at 27 in all sessions. It is common knowledge that the total number of periods and the period randomly drawn for payment have been determined before the beginning of the experiment. At the end of the session subjects learn which period was randomly selected for payment; the decisions made in this period determine the subject's payoff in the Investment Game. The game was played in four between-subject treatments: the Random Pairs treatment (which constitutes our baseline), the Fixed Pairs treatment, the Random Triplets treatment and the Fixed Triplets treatment. We describe each treatment successively.

Random Pairs Treatment: This treatment corresponds to a setting without reputation and without competition. Half of the subjects are randomly assigned the role of a project manager ("participant A" in the instructions, see Appendix A) and the other half the role of an investor ("participant B"). Roles are fixed throughout this part. In each period, a project manager is matched with an investor and pairs are randomly rematched at the beginning of each new period. We now describe the timing of each period.

(*i*) First, Nature randomly draws a set of three cards for each project manager. The

[15] We acknowledge that such uncertainty may introduce an additional source of heterogeneity across subjects, but this is kept constant across treatments and we are mainly interested in treatment comparisons.

cards convey information on the quality of the project manager's projects. Each card has a (independent) 0.5 probability of displaying a star, which indicates a successful project. If the card does not display a star, it is blank. Only the project manager can observe his three cards and see how many of display a star. The total number of stars τ is then in the $\{0, 1, 2, 3\}$ set.

(*ii*) Then, the project manager sends a cheap-talk message m to the investor regarding the number of cards that display a star, where $m \in \{0, 1, 2, 3\}$. Although this possibility is not stated in the instructions, m can differ from τ: a project manager can misreport the number of stars observed to motivate the investor to invest.

(*iii*) The investor receives an endowment of 100 tokens. After observing m, the investor decides on an action $a \in \{Invest, Not\ Invest\}$. If $a = Invest$, the entire endowment has to be invested.

(*iv*) Nature randomly draws one of the project manager's three cards, which determines the quality of the selected project, $\theta(\tau) \in \{Star, No\ Star\}$. If the selected card displays a star, the investment is a success; if the card is blank, it fails.

(*v*) Finally, both the project manager and the investor learn θ, regardless of whether the investor invested or not, and receive payoffs. A history box is also displayed on the subjects' screen. This history box lists (m, a, θ, π^i) for each past period. The past values of τ are only part of the history box for the project managers and investors never learn τ.

Figure 1 displays the timeline of the game.

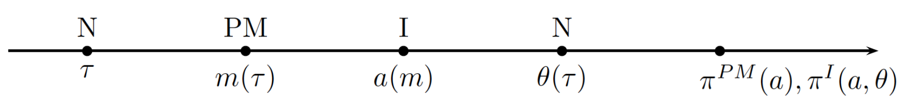


Figure 1: Timeline of the Game

The project manager's payoff is state independent and determined entirely by a:

$$\pi^{PM}(a) = \begin{cases} 30 & \text{if} \quad a = \text{Not Invest} \\ 230 & \text{if} \quad a = \text{Invest} \end{cases}$$

The project manager earns a fixed amount of 30 tokens plus 200 tokens if the investor invests, regardless of θ, the quality of the selected project.[16]

[16]This captures both the high share of variable pay in the earnings of advisers in financial institutions and the fact that variable pay depends on the ability to sell given products, not on the success of these products.

The investor's payoff is state dependent and also depends on a:

$$\pi^I(a,\theta) = \begin{cases} 100 & \text{if} \quad a = \text{Not Invest} \\ 30 & \text{if} \quad (a,\theta) = (\text{Invest, No Star}) \\ 300 & \text{if} \quad (a,\theta) = (\text{Invest, Star}) \end{cases}$$

If he does not invest, the investor earns his initial endowment (100 tokens). If he invests in a failed project, his net payoff is 30 tokens. If he invests in a successful project, his net payoff is 300 tokens, triple of the amount invested. Thus, interests are aligned when the initial state of nature is good (*i.e.*, so long as $\tau \geq 1$ since a perfectly informed risk neutral investor should rationally invest if the set of cards includes at least one star). But they are unaligned when it is bad: when τ=0, project managers would like the investor to invest, but by doing so the investor would lose most of his endowment.

Fixed Pairs Treatment. This treatment allows us to isolate the impact of reputation-building on truth-telling and investment. Rules are similar to those of the baseline except that the investor and the project manager remain in a fixed pair throughout the Investment Game.

Random Triplets Treatment. This treatment introduces a two-stage three-player game that allows us to isolate the impact of competition between project managers on truth-telling and investment. In this treatment, two thirds of the subjects are assigned the role of project manager (participants "A1" and "A2") and one third are assigned the role of investor. In each period, two project managers are randomly re-matched with one investor. In other words, triplets are reshuffled at the beginning of each period. Nature randomly and independently draws three cards for each project manager ($\tau^{PM1} \in \{0,1,2,3\} \perp \;\; \tau^{PM2} \in \{0,1,2,3\}$), and a project manager can only observe his own set of cards. Then, simultaneously, each project manager sends a message to the investor (m^{PM1}, m^{PM2}). After receiving the two messages, the investor decides on an action $a \in \{Not\,Invest,\;Invest\,with\,PM_1,\;Invest\,with\,PM_2\}$. Then, Nature randomly draws one of the three cards from each project manager: $\theta(\tau)^{PM1} \in \{Star, No\;Star\} \perp \;\; \theta(\tau)^{PM2} \in \{Star, No\;Star\}$. Finally, both the project managers and the investor are informed on whether the two cards randomly drawn (one for each project manager) show a star or not. The history box shows the two project managers' announcements, whether the two selected cards displayed a star or not, whether the investor invested and with which project manager, as well as that player's payoff. In addition, each project manager also saw his past values of τ.

The investor's payoff is determined as in the Random Pairs treatment: if he does not invest he earns his endowment (100 tokens); he earns 300 tokens if he invests in a successful project and 30 if he invests in a failed project. A project manager earns 230 only if he is selected by the investor, otherwise he earns 30 tokens. The project manager's payoff is modified as follows:

$$\pi^{PM_i}(a) = \begin{cases} 30 & \text{if} \quad a \in \{\text{Not Invest, Invest with PM}_j\} \\ 230 & \text{if} \quad a = \text{Invest with PM}_i \end{cases}$$

Fixed Triplets Treatment. This treatment allows us to measure the combined effects of reputation and competition on truth-telling and investment. The rules are similar to those of the Random Triplets treatment, except that the same two project managers and investor remain matched together in a fixed triplet in all the periods of the Investment Game.

3.1.2 The Simplified Investment Game

The outcome of the investment involves compound lotteries and we know that individuals may face difficulties calculating the return of an investment with such compound lotteries (*e.g.*, Abdellaoui et al. (2015)). To facilitate subjects' understanding and to better understand their risk preferences, before subjects play the Investment Game we implemented a simplified version of it in which subjects are paired with a truth-telling computer.[17] All subjects play the role of an investor and they play 16 such periods as practice.[18]

After the practice periods, subjects make decisions that can each matter for payment. Subjects have to decide on whether to invest or not in *each* of four scenarios corresponding to $\tau = (0, 1, 2, 3)$. At the end of the session, the program selects three cards for each subject, determining the relevant scenario. It then draws one of these three cards and computes the payoff of the subject corresponding to his action in the realized state θ. This determines the subject's payoff in the Simplified Investment Game.

3.1.3 Social Preferences and Other Individual Characteristics

In the Investment Game, decisions may be influenced by social preferences. To assess whether the distribution of social preferences is similar across treatments, subjects play the Allocation Game directly following the Investment Game. In Pairs treatments, in each round of the Allocation Game, subjects are paired randomly. In each pair one subject has

[17]The rules are the same regardless of the treatment implemented in part 2, and subjects are not aware of the rules for part 2 when they play the Simplified Investment Game.

[18]Subjects are informed on the probability of observing each number of stars among the three cards. Moreover, to facilitate learning, the program was built such that all the subjects can experience the distribution of probabilities in the practice periods: in two periods the three cards show no stars, in six periods they show one star, in six periods they show two stars, and in two periods they show three stars, all displayed in a random order at the individual level.

the role of the X player and the other has the role of the Y player. Roles and partners are assigned randomly and independently from the roles and pairs assigned in the Investment Game. All the subjects make 15 decisions as player X under the veil of ignorance. Then, a random draw assigns a role to each subject and selects one decision for payment. Only the decisions of the X players matter for payment. In Triplets treatments, there are three roles, X, Y and Z; all subjects make 18 decisions as X players under the veil of ignorance. In all cases, the order of decisions is randomized at the individual level. In each round, the X player has to choose between two allocations that determine payoffs for himself as well as the person (or people) he is matched with. Details are provided in Table C1 in Appendix C.

Finally, we administer the Machiavellianism (Mach IV) test (Christie and Geis, 1970) to collect a measure of manipulativeness (see Appendix A). Then, subjects receive a feedback on their payoffs in each part and answer to a standard socio-demographic questionnaire.

3.2 Procedures

We first summarize the experimental flow. In Part 1 of the experiment, subjects participate in the Simplified Investment Game. In Part 2 they play 27 periods of the Investment Game. In Part 3 subjects participate in the Allocation Game. In Part 4 subjects take the Mach IV test. Finally, subjects answer a standard socio-demographic questionnaire.

The experiment was run at the GATE-Lab in Lyon, France. 579 participants (56.65% of female) were recruited via HRoot (Bock et al., 2014) mainly among students from local engineering, business and medical schools. We ran 18 sessions for the main experiment: 4 sessions with 84 subjects in the Random Pairs treatment, 4 sessions with 78 subjects in the Fixed Pairs treatment, 5 sessions with 117 subjects in each of the Triplets treatments. We also ran two robustness treatments (for a total of ten sessions with 183 subjects), which we describe in Section 5.6. The experiment was programmed using z-Tree (Fischbacher, 2007).

Upon arrival, subjects randomly drew a ticket from an opaque bag indicating their terminal number. The instructions for each part were distributed at the beginning of each part and read aloud. Sessions lasted about 1.5 hour. Subjects were paid the sum of their payoffs in the first three parts: the payoff for the payoff-relevant decision in the Simplified Investment Game, the payoff for one randomly chosen round in the Investment Game, and the payoff for one randomly chosen round in the Allocation Game. Subjects were informed on their payoff in each part only at the end of the session. In addition, subjects received a 5-Euro show-up fee. The average earnings were 17.8 Euros. Subjects received their earnings in cash and in private in a separate payment room at the end of their session.

4 Predictions

4.1 No Behavioral Types

Selfish Preferences

As in other cheap talk games, there are multiple equilibria in our Investment Game. With risk-neutral players with selfish motives and no behavioral types, truth-telling cannot be supported in our treatments.

Theorem 1. *In the absence of behavioral types, a truth-telling equilibrium cannot be supported in any treatment. Indeed, project managers do not make announcements that lead to no investment, and a risk neutral investor invests in all periods. A sufficiently risk averse player never invests.*

Proof. In expectation investors are always better off investing than not.[19] Thus, in the last period, project managers do not send a signal that reduces the likelihood of an investment, so truth-telling leads to a lower payoff than lying. Consequently, payoffs in last period are given. The same rationale applies to the period before last, and to the previous ones.[20] □

Theorem 2. *In the Fixed Triplets treatment, truth-telling can be sustained for a limited number of periods early on, which depends on how many periods a subject believes are left. In this equilibrium, both project managers tell the truth for* k *periods and then, from period* k+1 *onwards, they switch to babbling. The investor invests with the highest announcer (so long as the announcement is greater than 0 stars) for the first* k *periods. After the first* k *periods the investor invests with the project manager who was most likely to have told the truth (given announcements and draws).*

Proof (intuition). Intuitively, if there are sufficiently many periods left, project managers will prefer to tell the truth and sacrifice early investment in order to increase the likelihood of later guaranteed investment. The full proof is in Appendix B.

Preferences for Efficiency

We note that if we assume that subjects have preferences for efficiency, then investment also occurs in every period. Indeed, investment coincides with the efficient choice, regardless of the true number of stars. Thus, preferences for efficiency also lead to investment in every

[19]It is profitable to invest when at least one star is drawn: the expected profit from investing with τ=1 is 120 (=(300*0.33+30*0.67)), which is higher than the certain payoff of 100 if one does not invest. The expected number of stars being 1.5, investors should always invest except when m=0.

[20]Note that in our settings, babbling equilibria are Pareto-efficient (but our typology of lies does not depend on this property). This is in contrast with canonical models such as Crawford and Sobel (1982) where babbling equilibria are inefficient for both sender and receiver.

period and the project manager announcements are irrelevant (and can thus be truthful in equilibrium).

4.2 Behavioral Conjectures

Behaviorally, investors may react adversely to the realization that they have been lied to, making their behavior history-dependent, and leading them to seek to punish detected liars. Regarding project managers, we may observe more honesty than would be predicted by Theorem 1. This honesty may come from one of two sources. First, while we deliberately chose parameters so that the gains from lying would potentially outweigh moral costs, project managers who have a very strong preference for honesty or perceived cheating aversion (Dufwenberg and Dufwenberg, 2018; Gneezy et al., 2018; Abeler et al., 2019; Khalmetski and Sliwka, 2019) may more truthfully report their cards. The second source may come from the fact that project managers may anticipate punishment from investors, and adapt their behavior to the environment they face, leading to differences in how and when they lie. Below we articulate our conjectures for investors and project managers.

Behavioral Conjecture for Investors While both the "standard" theory or preferences for efficiency predict that any given investor should behave identically across periods (always invest assuming only moderate risk aversion), we conjecture the following behavior instead:

1. *Investor Behavioral Conjecture 1: Investor behavior is history-dependent.* If this is the case, investors may only invest in some periods and not in others.
2. *Investor Behavioral Conjecture 2: Investors punish project managers caught lying by not investing with them in the next period.* If this is the case, in the two Fixed treatments, we should observe a drop in investment with a given project manager in the periods following the ones in which that project manager was caught lying. There should be less of a period-to-period difference in the Random treatments where directed punishment towards the project manager who was caught lying is not possible.

Behavioral Conjectures for Project Managers

The prior literature has shown that in certain contexts, individuals may be reluctant to lie for intrinsic reasons. The parameters we chose for the Investment Game are selected with the objective that these preferences only play a minimal role. We show in the results section that we achieve that goal, and thus we focus here on how people lie in markets rather than on how they may refrain from doing so because of intrinsic preferences.

1. *Project Manager Behavioral Conjecture 1: Maintaining Deniability:* In the Fixed treatments, project managers primarily lie in a way that maintains plausible deniabil-

ity. In this case, the motivation is mainly extrinsic and should lead to very different lying behavior between the Fixed and Random treatments. There should be far fewer detectable lies in the Fixed treatments than in the Random ones, and instead, we should primarily observe strategies that maintain plausible deniability. In the Random treatments, any kind of lie may occur.

We highlight one particular strategy that maintains plausible deniability, which we term the Deniable Lie strategy. With this strategy, project managers are truthful when they face 3 stars, and otherwise when they lie only make lies that can be denied. The Deniable Lie strategy is part of a partially informative equilibrium in the Fixed Pairs treatment, since with this strategy the investor invests in all periods and there is no incentive for the project manager to change strategy.[21] In this strategy, project managers never make announcements that can be incompatible with Nature's draw.

5 Results

In order to evaluate our data, we report the results of non-parametric tests. We average values at the individual level; thus, tests are run using a single observation per individual and they are two-sided except when otherwise specified. In all that follows, unless otherwise stated, the p-values when comparing across treatments are the results of Mann-Whitney rank-sum tests, and the p-values when comparing within treatment are the result of Wilcoxon matched-pairs signed-ranks tests. Our results are confirmed via the use of regressions with standard errors clustered at the session or individual level, as well as without clustering at all, with or without controls for observables and/or social preferences and Machiavellian measures.[22] In the interest of space, in Appendix G we only report a subset of these regressions, though any additional ones are available upon request.

We begin by presenting aggregate statistics on lying and investment behavior, showing that the predictions of the "standard" model do not explain behavior. Next, we analyze project managers' behavior across our various institutional arrangements through a typology of lies. Then, to understand the diversity of project managers' strategies we examine investors' punishment behavior. We continue with an analysis of investors' decisions and earnings. We complement this analysis by rejecting alternative motivations of the project managers, and we conclude this section with various robustness tests.

[21] The equilibrium in which project managers use the Deniable Lie strategy is one in which risk neutral and moderately risk averse investors invest in every period; this equilibrium is payoff-equivalent to a babbling equilibrium even though, as opposed to babbling equilibria, some information is transmitted here.

[22] While point estimates and levels of significance may vary from regression to regression, in no case do we observe contradictory outcomes, for example a change in the sign of a coefficient.

5.1 Overall Lying and Investment Behavior

The top panel of Table 1 shows the fraction of subjects who never or always invest. In the bottom panel, we present statistics on how frequently project managers lie across all periods and regardless of their actual draws, as well as how early in the game lying happens.[23] These statistics are sufficient to evaluate how well Theorems 1 and 2 as well as the first conjecture regarding investor behavior corresponds to the data.

Table 1: Lying and Investment Rates Across Treatments

Treatments	Random Pairs	Fixed Pairs	Random Triplets	Fixed Triplets
Investors				
Fraction of subjects who never invest	0%	0%	2.6%	0%
Fraction of investors who always invest	2.4%	0%	7.7%	12.8%
Project Managers				
Fraction of untrue announcements	50.4%	30.5%	60.1%	33.2%
Fraction who lie in the first period	21.4%	15.3%	47.4%	28.2%
Fraction who lie within the first 5 periods	73.8%	69.2%	85.9%	69.2%
Fraction who lie by the last period	83.3%	97.4%	92.3%	92.3%

The top panel clearly shows that investment behavior is not uniform across all periods and that in fact the vast majority of investors invest in some periods and not in others. Figures E2 and E3 in Appendix E also show that investment tends to decrease slightly over time in all treatments, except when both competition and reputation are present. This is inconsistent with Theorem 1, which predicts investment in all periods. We note here that in the context of Theorems 1 and 2, risk aversion cannot explain these patterns either since according to their predictions, a given subject should only behave in one of two ways: risk-neutral subjects (as well as subjects with a "low enough" level of risk aversion) should always invest, whereas those who are moderately or very risk averse should never invest. Similarly strong preferences for efficiency cannot explain these patterns since investment always yields a higher level of efficiency regardless of Nature's draw.

These aggregate investor data are, however, consistent with Conjecture 1 regarding investors, which hypothesizes that investors may take past experience into account when deciding on whether to invest in a given period.

Turning to project managers, the last row shows that the vast majority of subjects lie by the end of the game (*i.e.*, at least once in any period). These fractions range between 83.3%

[23] We present more disaggregated and detailed data in subsequent sections, where we narrow in on project manager and investor behavior.

and 97.4% across treatments, for a weighted average of 92.2%.[24] While Theorem 1 was rejected based on investor behavior, finding very little truth-telling is not inconsistent with Theorem 1 as it relates to aggregate project manager behavior (specific project manager behavior and possible strategies are the focus of later sub-sections). However, project manager behavior is inconsistent with Theorem 2 as lying in the Fixed Triplets treatment is not less frequent than in all other treatments, even at the beginning of the game.[25,26] Moreover, figure E1 in Appendix E shows that the relative frequency of lies is stable over time in all treatments.

Result 1: (1) We reject Theorems 1 and 2: the data are not consistent with a "standard" theory or with one that includes pure preferences for efficiency. (2) We find initial support for Conjecture 1 for investors: Investor behavior appears to be history-dependent.

5.2 A Typology of Lies

We now focus on project managers and evaluate how different market structures impact the nature of their lies and the strategies they may adopt. We start by presenting the empirical and expected distributions of announcements in Table 2. The fraction of "low" announcements (0 or 1 stars) is significantly lower than the fraction of "high" announcements (2 or 3 stars), when they should be equal if project managers told the truth ($p < 0.001$ in all four treatments).[27]

More informative is which announcements project managers choose when faced with different numbers of stars. This is shown in Figure 2, where we display the distribution of announcements after observing 0, 1, 2 and 3 stars (Subfigures 2a, 2b, 2c and 2d). The data show strong evidence that project managers' lies are not uniform across the settings we study. Instead, they vary based on both the treatment and on the number of true stars observed.

Indeed, in the Fixed Pairs and Triplets treatments for example, after observing 0 stars (Subfigure 2a), 24.3% and 29.5% of announcements, respectively, are of 2 stars (lies of

[24] These percentages show that, in our settings, only a small percentage of subjects may have intrinsic preferences for truth-telling that would outweigh the benefits of lying, as expected given our parameter choices. We rule out preferences for being seen as honest in the eyes of others in the next sub-section.

[25] A series of tests of proportions comparing the Fixed Triplets treatment with the others shows that whether in the first or first five periods, the fraction of lies is no different than in the Random or Fixed Pairs treatments ($p > 0.10$ in all cases). It is, however, lower than in the Random Triplets treatment ($p = 0.053$).

[26] Incidentally, it is interesting to note that in both Triplets treatments a high proportion of project managers lie starting from the very first period of play (47.4% in Random Triplets and 28.2% in Fixed Triplets). That is, project managers lie before they learn anything about a possible discrepancy between the announcement and the drawn card of their competitor. This rules out that the high fraction of liars in these treatments is due to subjects learning about the "norms of dishonesty" in the population.

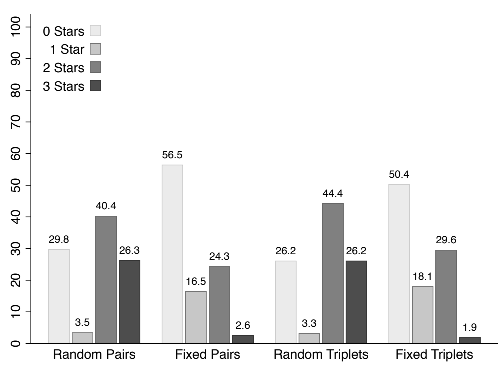
[27] Here, we calculate the probability of an announcement greater or equal to 2 for each subject and then compare the sample proportion to 50% using a test of proportion.

Table 2: Distribution of Announcements by Treatment

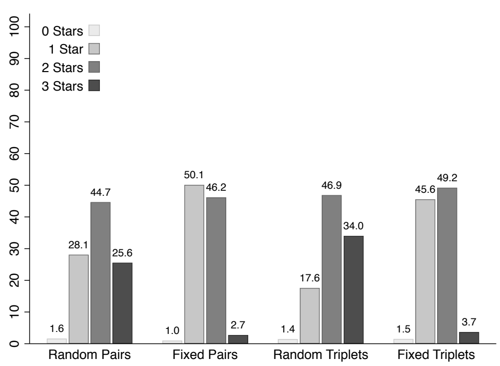
Treatments	Random Pairs	Fixed Pairs	Random Triplets	Fixed Triplets	*Expected Distribution under truth-telling*
0 Stars Announced	3.7%	6.7%	4.3%	6.9%	*12.5%*
1 Star Announced	11.4%	21.3%	6.9%	19.5%	*37.5%*
2 Stars Announced	47.7%	53.5%	43.8%	52.5%	*37.5%*
3 Stars Announced	37.2%	18.5%	45.0%	21.1%	*12.5%*
Total	*100%*	*100%*	*100%*	*100%*	*100%*
Mean Announcement	2.2	1.8	2.3	1.9	*1.5*

magnitude 2). In contrast, after observing 1 star (Subfigure 2b), lies of magnitude 2 occur only 2.7% and 3.7% of the time, respectively, in these treatments. Lies of magnitude 1 are also more common after observing 1 star (Subfigure 2b) than after 2 stars (Subfigure 2c). For example in the Fixed Pairs treatment, these fractions go from 46.2% to 15.6%, and in the Fixed Triplets from 49.2% to 17.1%. This suggests that when deciding on which announcement to make, for a large fraction of individuals, the size of lies depends on strategic considerations, which in turn depend on the institution in place.

Figure 2: Distribution of Announcements Conditional on the Observed Number of Stars, by Treatment.

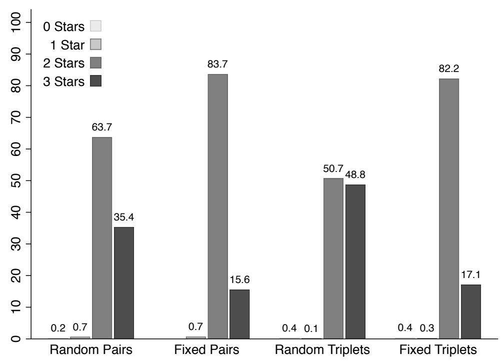


(a) Announcements after observing 0 stars

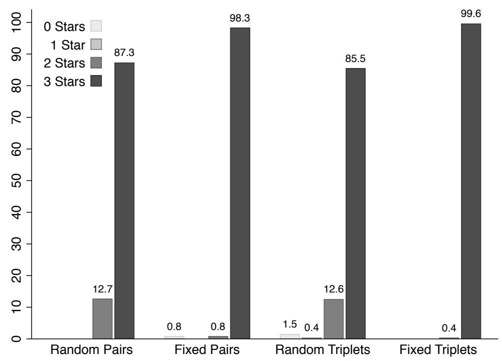


(b) Announcements after observing 1 star

Moving towards better understanding project manager strategies and what might lead to them, we shift our focus to those subjects who lied at least once over the course of the game. We categorize lies into four mutually exclusive types and analyze how frequently project managers make these types of lies. **"Extreme"** lies are lies that will be detected *ex post* with 100% certainty (*i.e.*, announcing 3 stars when one has none); **"High Risk"** lies are lies that will be detected *ex-post* with probability 2/3 (*i.e.*, announcing 3 stars when one has only 1); **"Low(er) Risk"** lies are lies that will be detected *ex-post* with



(c) Announcements after observing 2 stars



(d) Announcements after observing 3 stars

probability 1/3 (*i.e.*, announcing 3 stars when one has only 2); **"Deniable"** lies are lies that cannot be detected *ex-post*, *i.e.*, announcing 2 stars when one has observed fewer than 2, or announcing 1 when one has observed none.[28]

Table 3 reports the empirical distribution of lies. Its top panel shows the fraction of times subjects who lie at least once make Extreme, High Risk, Low(er) Risk and Deniable lies in each treatment, appropriately conditioned on the true observed number of stars (for example, for Extreme lies we look at cases when a subject actually saw no stars and calculate the fraction of times that subject made an extreme lie). In other words, we focus on the intensive margin of lies. The bottom panel of this Table shows the fraction of subjects who engage in each type of lies at least once (extensive margin), and, in the last row, the fraction who make detectable lies at least once (Extreme, High Risk and Low(er) Risk).[29]

Table 3 shows that absent reputation mechanisms, up to 97.2% of project managers who lie at least once make detectable lies, that is they announce 3 stars when they in fact face fewer then 3 stars, whether in the form of Extreme, High Risk or Low(er) Risk lies. This means that they take actions that can result in being detected as a liar by the investor they are matched with.[30]

Instead, large cross-treatment differences suggest that when deciding how to lie, individuals may be anticipating and reacting to the material consequences of being caught lying.[31] Consistent with the behavioral conjecture for project managers, among the subjects who

[28]There is another category of lies: "Downward" lies, *i.e.*, announcing fewer stars than actually observed. For the sake of concision we do not comment on them, as they seldom happen (see Figure 2).

[29]In Appendix D Table D1, we present these statistics without restricting them to subjects who lie at least once. Given that the vast majority of subjects do lie at least once, there are no substantive differences between the two tables.

[30]We also use these data to note that, as expected by our parameter choices, the gains from engaging in these types of lies outweigh any benefits from not being perceived (let alone identified) as a liar by others.

[31]The material consequences to being caught lying are indeed confirmed in the next sub-section.

Table 3: A Typology of Lies – Intensive and Extensive Margins

Treatments	Random Pairs	Fixed Pairs	Random Triplets	Fixed Triplets
Intensive Margin				
Extreme Lies	27.9%	1.4%	30.8%	2.0%
High Risk Lies	30.7%	2.5%	35.8%	3.7%
Low(er) Risk Lies	41.5%	16.7%	53.2%	18.1%
Deniable Lies	52.1%	46.7%	50.6%	51.2%
Extensive Margin				
Extreme Lies	44.1%	2.8%	53.6%	7.1%
High Risk Lies	62.9%	13.2%	79.2%	23.6%
Low(er) Risk Lies	77.1%	50.0%	93.1%	54.2%
Deniable Lies	85.7%	97.4%	93.1%	95.8%
Detectable Lies	82.9%	50.0%	97.2%	59.7%

Notes: These data focus on subjects who lie at least once. The intensive margin is given by the fraction of times subjects make each type of lies in each treatment, conditioned on the true observed number of stars. The extensive margin is given by the fraction of subjects who engage in each type of lies at least once. The last row indicates the fraction of subjects who make detectable lies at least once.

make at least one lie, the fraction of those who make at least one Detectable lie is significantly lower in the Fixed treatments where direct punishment is possible than in the Random treatments (the $p-values$ on tests of probabilities are all strictly less than 0.001).

We find strong support for the fact that a large fraction of subjects adapt their lying so as to not be identified as a liar in the Fixed treatments, but not in the Random treatments, as described in Behavioral Conjecture 1. While a large majority of subjects engage in Deniable lies at least once in every treatment (between 85.7% and 97.4% depending on the treatment),[32,33] in the Fixed treatments the Deniable Lie strategy (be truthful when the truth is 3 stars, otherwise only lie in a deniable way) is common. In fact, in the Fixed Pairs treatment, 47.4% of project managers employ the Deniable Lie strategy. This fraction is 40.3% in the Fixed Triplets treatment. These are the most common strategies in the Fixed treatments. This strategy is much less frequent in the Random Pairs and Random Triplets treatments where only 8.6% and 1.4% of project managers employ this strategy, respectively.

As a consequence of not wanting to face the possible material cost of being caught lying, the only market mechanism that leads to a dramatic decrease in lies is reputation. How-

[32]These fractions are statistically no different across treatments: tests of probabilities are all above 0.10. The prevalence (intensive margin) is also not statistically different across treatments ($p > 0.10$ in all pairwise comparisons of ranksum tests), and is above 45% in all treatments.

[33]These analyses are confirmed by regressions, as reported in Table F1 in Appendix G.

ever, this is not uniform across all types of lies. Indeed, also in line with the behavioral conjecture for project managers, the impact of reputation is dramatic in terms of Extreme lies, as it practically eliminates them, both at the extensive margin (2.8% and 7.1% in the Fixed Pairs and Triplets treatments *vs.* 44.1% and 53.6% in the Random Pairs and Triplets treatments, respectively) and at the intensive margin (1.4% and 2% in the Fixed Pairs and Triplets treatments *vs.* 27.9% and 30.8% in the Random Pairs and Triplets treatments, respectively).[34] While at the extensive margin a non-negligible portion of project managers engage in High Risk lies at least once when they can build a reputation, the impact of reputation remains dramatic (13.2% *vs.* 62.9% in the Fixed Pairs and Random Pairs treatments, and 23.6% *vs.* 79.2% in the Fixed and Random Triplets treatments, respectively).[35] In addition, the frequency at which they do engage in High Risk lies is significantly lower than in the presence of reputation (2.5% *vs.* 30.7% in the Pairs treatments and 3.7% *vs.* 35.8% in the Triplets treatments — $p < 0.001$ in both comparisons). These patterns continue in the domain of Low(er) Risk lies, though we note that such lies are no longer rare, whether at the intensive or expensive margins.[36]

Turning to the role of competition, we find that while reputation changes the nature of lies in stark ways across treatments, competition never reduces any of the four types of lies. In fact, it can even increase some lying, as is the case in the absence of reputation when looking at the extensive margins of High Risk lies ($p = 0.072$) and Low(er) risk lies ($p = 0.018$). In the other situations, it has no significant impact.

Result 2: (1) In the Fixed treatments, between 40% and 50% of the project managers employ the Deniable Lie strategy, in which they only make lies that for sure cannot be detected, and truthfully announce 3 when they face 3 stars. (2) Consistent with project manager Behavioral Conjecture 1, we find that very few Extreme and High Risk lies occur in the Fixed treatments. These fractions are significantly lower than in the Random treatments. This is also the case for Low(er) Risk lies. (3) Consequently, reputation is the only market mechanism studied here that, while far from eliminating lies, reduces the fraction of project managers who engage in detectable lies, in particular the most egregious ones (Extreme and High Risk). However, it has no impact on the frequency of Deniable lies.

5.3 Investor Punishment Behavior

We now turn to investor behavior and show that lies are frequently discovered by investors, which leads to punishment in the form of non-investment (Investor Behavioral Conjecture 2).

[34] $p < 0.001$ in all Random *vs.* Fixed comparisons).

[35] $p < 0.001$ in all Random *vs.* Fixed comparisons).

[36] All statistical comparisons between the Fixed and Random treatments continue to yield statistically significant p-values that are at most 0.016.

Lies are immediately detected when Nature draws a blank card after a 3 star announcement. Table 4 reports the frequency with which subjects in each treatment detect a lie, as well as the fraction of project managers who get caught and how early lies are detected on average.[37]

Table 4: Distribution of the Number of Periods an Investor has been Lied to and Knows it

Treatments	Random Pairs	Fixed Pairs	Random Triplets	Fixed Triplets
Never	4.8%	66.7%	0%	35.9%
1-3 periods	38.1%	25.7%	2.6%	46.2%
4 periods or more	57.2%	7.7%	97.4%	18.0%
% PM who get caught	71.1%	32.4%	84%	43.2%
Period first lie detected (average)	6.8	11.9	6.2	10.0

Notes: In the Triplets treatments, for comparability, we count a lie across project managers. If in a period an investor can tell he has been lied to by at least one project manager, this will count as one lie. If both project managers lie, this still counts as one lie. Regarding the fraction of project managers who get caught, this is conditional on having seen 0 stars at least once.

Our data show that in the Random treatments, without the presence of reputation, investors are frequently aware that they have been lied to, as would be expected given project manager announcement behavior. Fixed matching drastically lowers the number of times investors detect a lie: the percentage of investors who never detect a lie increases from 4.8% to 66.7% in the Pairs treatments and from 0 to 35.9% in the Triplets treatments.[38] While fewer project managers get caught with reputation than without it, a significant fraction of subjects in our Fixed treatments discover that the project manager they are matched with (or one of the project managers in the Fixed Triplets treatment) has lied to them: the fraction of project managers who get caught is substantial at 32.4% and 43.2% in the two treatments. Furthermore, in addition to lowering the instances of detected lies, reputation delays detection, though this detection is still relatively early in the game: on average, periods 11.9 and 10 in the Fixed Pairs and Triplets treatments, *vs.* 6.8 and 6.2 in the Random Pairs and Triplets when reputation is absent.[39]

How does detecting a lie impact future investor behavior? The data presented in Table 1 showed that investor behavior may be history-dependent (Investor Behavioral Conjecture

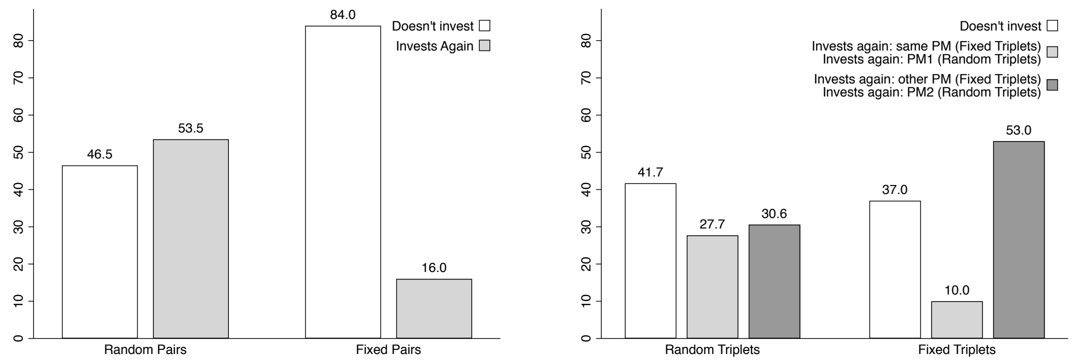
[37] If both project managers lied in a period in the Triplets treatments, this counted as a single lie. The frequency at which an investor might think he is matched with a liar in the Fixed treatments is likely higher. Suppose a project manager sends message 0 when he gets 0 stars, message 3 when he gets 3 stars, and message 2 the rest of the time. After several periods, the investor should deduce that he is paired with a liar.

[38] $p < 0.001$ in Fisher exact tests (non-aggregated, *i.e.*, full distribution) of the number of periods investors detect a lie.

[39] $p < 0.012$ in Fisher exact tests.

1) since investors' actions were not identical across periods. We now provide strong evidence that this is indeed the case, and further, identify what may drive this history-dependence. Figure 3 shows how subjects invest in the period directly following a detected lie in both the Pairs (panel 3a) and Triplets treatments (panel 3b).[40]

Figure 3: Investment Rates in Periods Directly Following a Detected Lie.



(a) Pairs Treatments *(b) Triplets Treatments*

In the Random Pairs treatments, following a detected lie the average investment rate is 53.5%, compared with a 62.1% investment rate in periods after no lie was detected. At the individual level, subjects are no less likely to invest after a lie than after a period in which no lie was detected ($p = 0.104$). Thus, investors do not punish the current project manager if the project manager in the previous match was identified as a liar, showing no evidence of immediate indirect punishment. In contrast, when matching is fixed, following a detected lie the average investment rate is 16% compared with 58.4% when no lies were detected. At the individual level, subjects are significantly less likely to invest in the period following a detected lie ($p = 0.013$), showing that when they are able to directly punish a detected liar, they do so. This is the case even though the average announcement following a detected lie is no lower than the average announcement following an announcement not detected as a lie ($p = 0.861$). This provides an explanation as to why project managers in Fixed Pairs only seldom make Extreme and High Risk lies: investors punish liars although in expectation it is very costly to do so.

In the Random Triplets treatment, following a detected lie the average investment rate is 58.3% compared with 65.7% in periods following no detected lie. While the magnitude of the difference in average investment is not large, significantly more subjects lower their likelihood of investing rather than increase it, which suggests some indirect punishment ($p = 0.005$). In the Fixed Triplets treatment, following a detected lie 63% of subjects invest

[40]To keep treatments comparable, we did not consider periods after which both project managers were discovered to have lied. This event is rare: 2.66% of periods in Random Triplets and 0.09% in Fixed Triplets.

again, a fraction statistically no different than 73.5%, the investment rate after periods in which no lie was detected ($p = 0.389$). However, investors are significantly less likely to invest with the project manager who just lied, and the likelihood of reinvesting with that same project manager is only 10% ($p = 0.003$). That is, in contrast with the Fixed Pairs treatment, instead of exiting the market they shift to investing with the project manager who was not revealed to be a liar in the previous period. Here as well, we can rule out that this difference is due to lower announcements by the project manager who just lied, compared with the announcement of the non-lying or non detected project manager ($p = 0.412$). Thus, with reputation, competition allows subjects to punish liars without exiting the market, which makes punishment less costly for investors.

Finally, an extreme form of punishment is "permanent" exit, which in the Random treatments represents a "punishment of the profession" as opposed to the long-term punishment of a specific project manager as in the Fixed treatments. For each subject, we identify the final period they invested in and compare it across treatments. Table 5 shows the fraction of investors who exit before the 15th, 20th and 25th periods as well as average investment rates over the course of the game.

Table 5: Fraction of Investors who Permanently Exit Markets and Average Investment Rates.

	Random Pairs	Fixed Pairs	Random Triplets	Fixed Triplets
% who exit before 15th period	2.4%	2.6%	12.5%	2.6%
% who exit before 20th period	4.8%	7.7%	15.4%	2.6%
% who exit before 25th period	14.3%	23.1%	28.2%	2.6%
Average investment rate	60.0%	57.6%	63.5%	77.9%

We highlight here that the combination of competition and reputation provides a strong benefit for investors. It is only in the Fixed Triplets treatment that nearly all investors participate in the market until the end: only 2.6% of subjects no longer invest by the 25th period in that treatment, compared with between 14.3% and 28.2% in the others.[41] Thus, while competition does not make project managers more truthful, it does allow investors to punish a project manager who lied and was detected *without* exiting the market. This directly translates into a higher level of overall investment in that treatment. Indeed, regarding the average fraction of periods in which investors invest, the Random Pairs, Fixed Pairs and Random Triplets treatments are, statistically speaking, equivalent. Only the Fixed Triplets treatment has a level of investment significantly higher than the others.[42,43]

[41] The highest p-value in pairwise comparisons of the Fixed Triplets treatment with the others is 0.061.
[42] The highest p-value in a series of Rank-sum tests is $p = 0.063$.
[43] These analyses are confirmed by the regressions, as reported in Table F2 in Appendix G.

Result 3: (1) Consistent with Investor Behavioral Conjectures 1 and 2, when reputation is present investors punish project managers who are caught lying by not investing with them, showing that investors react to history. This provides the reasoning behind the project manager Deniable Lies strategy in the Fixed treatments. (2) In the absence of competition, punishment takes the form of exiting the market in the next period. (3) In the presence of competition, investors instead switch to investing with the other project manager and do not exit the market, implying that reputation, when accompanied by competition, results in higher investment levels.

5.4 Investors' Decisions and Earnings

In this sub-section, we compare first investment decisions and then earnings with the counterfactual under truth-telling provided by the Simplified Investment Game. Table 6 shows how frequently investors invest for a given announcement, and how this relates to investment behavior under truthful revelation as observed in the Simplified Investment Game.[44,45]

Table 6: Investment in the Investment and Simplified Investment Games, by Treatment

Treatments		Random Pairs	Fixed Pairs	Random Triplets	Fixed Triplets
0 stars announced:	% Investment Game	0.0% (25)	0.0% (30)	0.0% (3)	0.0% (6)
	% Simplified Inv. Game	2.4%	0.0%	0.0%	0.0%
1 star announced:	% Investment Game	11.4% (40)	9.0% (38)	0.0% (6)	15.6% (28)
	% Simplified Inv. Game	11.9%	7.7%	17.3%	15.4%
2 stars announced:	% Investment Game	65.1% (42)	72.6% (39)	58.3% (39)	73.6% (39)
	% Simplified Inv. Game	92.9%	97.4%	96.0%	92.3%
3 stars announced:	% Investment Game	77.4% (42)	92.3% (39)	66.4% (39)	92.6% (39)
	% Simplified Inv. Game	100%	97.4%	97.3%	97.4%

Notes: The Table shows the fraction of times investors invest in the Investment Game on the first line and in the Simplified Investment Game on the second line (where announcements were truthful by design). In the Triplets treatments the announcements refer to the highest announcement across both project managers. The number of subjects who faced a particular announcement is indicated in parentheses.

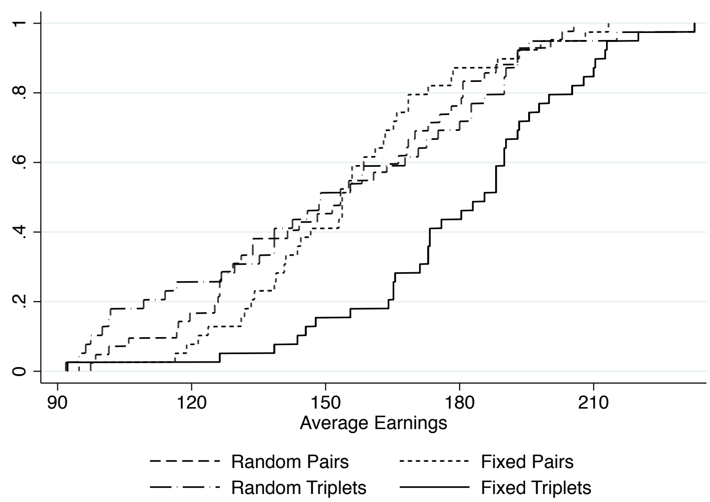
When announcements are low (0 stars or 1 star) investors generally find them credible and invest at similar rates compared with the Simplified Game, regardless of the market

[44]Note that there are no treatment differences in how subjects behaved in the Simplified Investment Game. In particular, this rules out that subjects in the different treatments of the main game had different tolerances towards risk. The p-values on tests of proportions in all pairwise comparisons are above 0.10.

[45]In the Triplets treatments the announcements refer to the highest announcement across both project managers. There are periods when both project managers announced the same number of stars: this happened in 38.6% and 36.2% of the periods in the Random and Fixed Triplets treatments, respectively. In the Triplets treatments, investors can choose to invest with the project manager who did not announce the highest number of stars: this happened in 15.6% and 4.5% of periods where an investment took place in the Random and Fixed Triplets treatments, respectively.

structure: they almost never invest when the announcement is 0 and do so infrequently when it is 1. However, after a 2-star announcement credibility is an issue in all treatments: investors invest significantly less than they did in the Simplified Game, realizing that such announcements can, in fact, be (deniable) lies.[46] After a 3-star announcement credibility remains an issue in the treatments without reputation. On the other hand, reputation significantly impacts how investors react to 3-star announcements. With or without the presence of competition, reputation protects investment levels compared with behavior in the Simplified Investment Game.[47] In other words, with reputation, subjects behave no differently than if they knew the 3-star announcement was truthful.

Figure 4: CDF of Investors' Earnings Across Treatments



These data, taken together with the data discussed earlier provide the explanations behind investor earnings across treatments. We display the cumulative distribution functions of investor earnings in all four treatments in Figure 4. We find no difference in the distribution of earnings nor in average earnings in the Random Pairs, Fixed Pairs and Random Triplets treatments, where they amount to 154.7, 154,9 and 151.0 tokens, respectively.[48] Instead, investors earn substantially more in the Fixed Triplets treatment, 180.1 tokens on average, than in any other treatment.[49] This is in large part the result of the availability of

[46] $p < 0.001$ in all treatments.

[47] p=0.267 and 0.564, when comparing behavior with that in the Simplified Investment Game, in Fixed Pairs and in Fixed Triplets, respectively. When reputation is not present, investment drops compared with behavior in the Simplified Investment Game ($p < 0.001$ in both Random Pairs and Random Triplets).

[48] The lowest p-value in Kolmogorov-Smirnov tests comparing the distribution of earnings in the Random Pairs, Fixed Pairs and Random Triplets treatments is $p = 0.224$. The lowest p-value on a series of rank-sum tests comparing average investor earnings over time is $p = 0.776$.

[49] All pairwise comparisons result in $p < 0.001$. Moreover, all the p-values in Kolmogorov-Smirnov tests

a punishment strategy that does not lead to a temporary or permanent exit of the market, as described in the previous sub-section.

How do these earnings compare to the earnings that would exist under truth-telling? In principle, lying could lead to better outcomes than truth-telling. Indeed, in the Simplified Investment Game, when announcements were truthful by design, relatively few investors invest when 1 star was announced, showing risk aversion. In expectation, however, they would be better off financially if they did invest at 1 star. We use behavior in the Simplified Investment Game to predict what subjects would have done under truthful revelation in the Investment Game. Relative to a situation with market truthfulness, in all treatments, including the Fixed Triplets treatment, average earnings are significantly lower than what they would be if investors knew the truth (166, 164.5, 202.5 and 201.2 in expectation in the Random Pairs, Fixed Pairs, Random Triplets and Fixed Triplets treatments, respectively).[50] In other words, overall, while investors may be pushed to invest more at 1 star than they otherwise would, the gains from these investments are far outweighed by the losses that come from investment errors that the asymmetric information generates.[51]

Finally, we point out that the difference in earnings relative to a truth-telling situation is particularly large in the Random Triplets treatment. Indeed, when investors are matched with two project managers, investors are objectively more likely to face an attractive investment opportunity. However, in the Random Triplets treatment, lying behavior results in investors implementing costly punishment strategies. Indeed, permanent exits from the market are highest in this treatment (as seen in Table 5), leading to earnings that are no higher than in either of the Pairs treatments.

Result 4: (1) Investor earnings are highest in the Fixed Triplets treatment, and are no different between the other three treatments: competition without reputation does not lead to better market outcomes for investors. (2) In all treatments clear and large losses arise from the lack of transparency, and investors do far worse than under truth-telling.

5.5 Other Motivations for Project Managers' Lies

We have provided evidence that project manager behave in line with Project Manager Behavioral Conjecture 1: when deciding whether to tell the truth or lie, they focus on their

comparing the distribution of earnings in the Fixed Triplets treatments and the others are lower than $p < 0.001$.

[50] Signed-rank tests comparing average earnings to the earnings if investors knew the truth are at most $p = 0.031$.

[51] In Appendix F we detail the different types of errors that arise from the asymmetry in information in the Investment Game: missed opportunities (investors not investing when they would have had they known the truth), and investment mistakes (investors investing when they would not have had they known the truth). Both are widespread in all treatments.

monetary gains: they do not want to be identified as liars only when this puts them at risk of being monetarily sanctioned by an investor. We now discuss other possible motivations.

We start by ruling out that a majority of project managers who lie have good *intentions* when they choose to lie. Indeed, very few investors invest after a 1-star announcement although it is profitable in expectation. By announcing a higher number of stars, a project manager would then increase the expected gain of the investor. While we have shown in the previous sub-section that investors are, on average, hurt by the asymmetry in information, we can rule out paternalistic motives even more strongly and at the individual level. We do so by focusing on those individuals who do lie and examining their behavior when faced with 0 stars. In this situation, a project manager knows for a fact that Nature will draw a blank card, resulting in a certain negative outcome for an investor who invests. If project managers who lie were acting out of good will, we would not observe any lies when the true number of stars is 0, and no difference between treatments. Yet, a large majority of these subjects also lie after observing 0 stars. This is the case for 85.3% of project managers in the Random Pairs treatment, 63.9% in the Fixed Pairs treatment, 85.5% in Random Triplets treatment, and 74.3% in the Fixed Triplets treatment. Moreover, they do so frequently (78.3% of the times they observe 0 stars in Random Pairs, 44.0% in Fixed Pairs, 77.1% in Random Triplets, and 48.0% in Fixed Triplets), showing that this behavior is both commonplace and persistent. To summarize, when there are fewer consequences of being caught lying, as in the treatments with no reputation, over 85% of subjects lie although they know for a fact that this will hurt the investor. Thus we can rule out paternalistic motives for a large majority of liars, as such motives are consistent with the data for no more than 15% of liars. In fact, the positive probability with which a lie benefits the investor in expectation, except when the project manager has no stars, may provide moral wiggle room for lying.

We also reject that preferences for efficiency are guiding project managers' announcements. First, we point out that subjects with preferences for efficiency should invest in all periods, as described in Section 4. This is a behavior that we do not observe. Given the random assignment of the roles of project manager and investor, we can assume that project managers in our experiment share the same social preferences as the investors. Second, we analyze project managers' specific choices in the Allocation Game in part 3. In this task, all but one question presented subjects with efficiency trade-offs (see Table C1 in Appendix C).[52] A series of two-sided tests of proportion show that subjects who do or do not display preferences for efficiency in the Allocation Game are no different in terms of whether they lie in the Investment Game, or whether they lie when they face 0 stars.[53]

[52]We note the caveat that choices in the Allocation Game might have been influenced by the events faced in the Investment Game.

[53]The smallest p-value is $p = 0.195$ when looking at whether answering all Allocation Game questions in a way that is consistent with preferences for efficiency impacts the probability of lying.

In addition, using Probit and OLS regressions we further find that the number of efficient choices in the Allocation Game also has no bearing on the probability of having lied at least once, the number of lies, or having lied at least once when 0 stars were observed (see Tables F3, F4 and F5 in Appendix G). Thus, project manager behavior is unlikely to be driven by subjects' preferences toward efficiency and these types of preferences cannot explain cross-treatment differences in how people lie in markets.

Finally, regression analyses controlling for other project manager characteristics (Machiavellian score or gender) rule out that innate differences in individual characteristics drive project manager behavior in the Investment Game. No clear pattern emerges regarding the impact of individual characteristics on a subject's probability of having lied at least once, the number of lies, or having lied at least once when seeing 0 stars, or making a detectable or Deniable lie (see Table F1 in Appendix G for example).

Result 5: (1) A large fraction (at least 85%) of project managers' decisions on how and when to lie is impacted by strategic considerations in order to increase gains. (2) A small fraction of project managers (at most 15%) who lie may also/instead be motivated by paternalism, not just personal monetary gains. (3) Machiavellian characteristics or differences in preferences towards efficiency do not explain patterns of lying.

5.6 Robustness Tests

We ran two additional treatments to test the robustness of our results and better understand how market mechanisms may be used to curtail lying. In our main treatments the time horizon is uncertain but finite and this could explain that competition with reputation does not further reduce lying. In a first robustness test we introduce an indefinite horizon in the Fixed Triplets treatment that supports the emergence of a truth-telling equilibrium. In a second test we remove communication in the Fixed Pairs treatment and measure the extent to which communication improves investors' earnings despite project manager biases.

Indefinite Horizon Fixed Triplets Treatment. We recruited an additional 111 subjects for six sessions of the Indefinite Horizon Fixed Triplets treatment, using the same protocol as for the main treatments. This treatment introduces an indefinitely repeated game in the Fixed Triplets treatment. Subjects play 20 periods for sure after which we induce a $\delta = 0.85$ continuation probability in each period. It is also made common knowledge that subjects would be paid for one of the first 20 periods with $p = 0.75$ and one of the remaining periods with $p = 0.25$.[54,55]

The data in the Indefinite treatment closely match those in the original Fixed Triplets treatment. The proportion of project managers who ever lie in the Indefinite treatment is not significantly different than in the Fixed Triplets treatment (90.5% *vs.* 92.3%, respectively, p=0.697). The proportions of project managers who participate in Extreme, Risky, Low(er) Risky and Deniable lies are no different either (5.4% in the Indefinite treatment *vs.* 6.6% in the Fixed Triplets treatment, 18.9% *vs.* 21.8%, 47.3% *vs.* 50.0%, and 87.8% *vs.* 88.5%, respectively (the smallest p-value is 0.660)).

On the investor side, investors invest as frequently in both treatments (71.5% of periods in the Indefinite treatment *vs.* 77.8% in the Fixed Triplets treatment, p=0.134). They react to specific announcements similarly. When facing a 1-star announcement, investment rates are 7.1% *vs.* 15.6%, respectively (p=0.203). After a 2-star announcement, they are 68.8% *vs.* 73.6% (p=0.631). After a 3-star announcement, they are 89.8% *vs.* 92.6% (p=0.702). Also, the pattern of permanent exit of the market is similar: 0% *vs.* 2.6% drop out before the 15th period (p=0.327), and 5.9% *vs.* 2.6% drop out before the 25th period (p=0.538).[56] Finally, investors' earnings are no different either: 174.7 *vs.* 180.1 (p=0.374).

In summary, we find no statistical differences in any side of the market between the Indefinite treatment and the Fixed Triplets treatment. Thus, our previous results are not due to the finite nature of our setting: lying is common regardless, project managers continue to engage in a high proportion of Deniable lies, and investors are hurt even in a indefinitely repeated setting.

<u>No Communication Fixed Pairs Treatment.</u> We recruited an additional 72 subjects for four sessions of the No Communication treatment, again using the same protocol as in the main treatments. This treatment was designed to test how investment behavior and earnings are modified in the absence of communication between project managers and investors. The No Communication treatment introduces two changes in the Fixed Pairs treatment. First, in each period of the Investment Game in the No Communication treatment, project managers still observe the three cards they are dealt but they take no action, and the investor

[54] This allows us to obtain at least 20 periods, just as in the Fixed Triplets treatment, and keep an exponential discount rate and stationarity with periods still reasonably likely to be played, even in the first 20 certain periods. The actual duration of the game in our six sessions was 21, 23, 25, 27, 30 and 33 periods. We thank Alistair Wilson for the creative suggestion, which as far as we know, has not been implemented in the laboratory as of yet. For a presentation of other methods see Fréchette and Yuksel (2017).

[55] We acknowledge that in a laboratory setting subjects can anticipate that the game will not last forever, which may differ from the exact conditions of the theory. This being said, previous studies have shown how subjects in the lab change their behavior in indefinitely repeated and finitely repeated games of the same expected length, as predicted by theory (*e.g.*, Dal Bó (2005)).

[56] When looking at the drop-out rate before the 25th period, we only include the Infinity sessions that had at least 27 periods, so that they are comparable to the Fixed Triplets treatment.

has to make a decision as to whether invest or not without facing any announcements. Second, in part 1 in addition to asking subjects how they would invest for various truthful announcements in the Simplified Investment Game, they play an 18th period where they have to decide whether to invest or not without knowing the content of the three cards.

The investment decision in the Simplified Investment Game when subjects must choose whether to invest in a project without knowing the success rate is a strong predictor of how frequently investor invests in the Investment Game, as well as of the probability that an investor invests in any given period. This is true also controlling for any combination of the following: (1) whether a star was drawn in the previous period, (2) the running average of successful projects up to the current period, (3) the number of efficient choices in the Allocation Game, (4) an indicator as to whether a subject showed preferences for efficiency in the Allocation Game, (5) their Machiavellian score.[57] In other words, the primary identifiable driver of investment absent communication is subjects' risk preferences.

Despite similar investment frequencies (57.6% and 56.9% in the treatments with and without communication, respectively, $p = 0.675$) earnings are substantially lower in the No Communication treatment: 137.4 tokens *vs.* 154.9 in the original Fixed pairs treatment ($p = 0.016$). Indeed, absent communication, investors often invest when it is not profitable. On the other hand, when project managers can communicate, "low" announcements are credible (the signal is informative) and investors can avoid some of the bad projects.

6 Discussion and Conclusion

In an economic environment where interest rates are very low, savings accounts usually pay mediocre monetary returns, which motivates more people to invest in risky assets. Given that a large fraction of individuals have low financial literacy, it is all the more important that these investors receive reliable advice from financial experts.[58] However, experts often receive sizeable bonuses that depend on their ability to attract investors and not necessarily on the success of their investments,[59] and so may be tempted to misrepresent their portfolio's expected return to potential customers. This type of misconduct is extremely difficult to measure with field data that can only document detected fraud (Egan et al. (2019)) but not the many lies that are deniable.

Using a lab experiment we have shown that in the absence of reputation, that is when

[57] Any and all regressions are available upon request.

[58] Lusardi and Mitchell (2014) reveal that a majority of people have trouble understanding financial notions such as compounding of interest rates, inflation and stock mutual funds with risk diversification. These findings replicate in France where our experiment was conducted (there, the percentage was 31%; see Arrondel and Savignac (2013)).

[59] This is the case, among others, for mutual fund managers who are rewarded for fund flows even if they do not outperform passive benchmarks. See Jensen (1968) and Berk and Green (2004).

investors cannot "track" project managers, project managers frequently make Extreme lies that will be detected with certainty *and*, assuming the investor invests, harm the investor. But project managers also frequently make lies that might not be detected (High Risk and Low(er) Risk lies), as well as Deniable lies that cannot be detected in any given period. This delivers two important findings: first, it is crucial to consider not only the prevalence of lies but also their nature; second, in a financial setting exaggerated announcements may be commonplace.

While reputation protects investors against Extreme and High Risk lies, it protects them less against fraudulent announcements with a lower risk of detection, and it does not protect investors at all against Deniable lies. Project managers do not become more honest across the board when they have to build a reputation, they mainly change the nature of their lies in order to not face the *financial costs* of being caught lying. We also find that competition does not make project managers more honest on average; in the absence of reputation, it can even have the opposite effect by increasing risky lies. However, one clear result that emerges is that competition in the presence of reputation increases investors' earnings, as it provides more opportunities and allows them to punish misbehavior without exiting the market. Competition gives investors more effective punishment means, as they can sanction without having to incur a substantial cost for punishing. Nevertheless, this can only apply to detectable lies, not to deniable ones. Note that to explore further the role of competition, it might be interesting to increase the size of the market, as the threat of leaving a project manager would be stronger with competition on a larger market.

How do our stylized laboratory market settings inform the world outside the lab? In real financial markets the turnover of financial advisers both within and across firms is usually high, and people can easily resurface with a "new" identity. Egan et al. (2019) show that the labor market partially undoes firm-level discipline and the presumed cost of loosing one's reputation is lessened. In our experiment, reputation, *i.e.*, the traceability of advisers, lowers the amount of fraud. In its absence, an investor cannot directly punish a detected lie, and the high prevalence of lies over time reveals the limited impact of punishment by investors. When reputation is present but competition is not, investors punish detected liars by not investing in the next period. However, when both reputation and competition are present, investors can punish liars by switching to their competitor—which decreases the amount of detectable fraud and helps maintain a relatively high level of investment, unlike in the other market settings. Although investors earn more when there is both reputation and competition between project managers, the lack of transparency entails losses for investors in our experiment. This is not to say that investors would fare better without advisers: our No Communication treatment shows that when there is no communication, investors earn less since they invest more often when the state of the world is bad.

These results do not contradict the literature on cheating games. Simply, in our setting, the expected monetary benefits of lies weigh more than their associated moral costs. Our data also allow us to reject the assertion that liars are motivated by paternalistic motives, preferences for efficiency, or a higher degree of Machiavellianism. The positive probability with which a lie benefits the investor in expectation, except when the project manager has no stars, may provide moral wiggle room for the project managers to lie. But if subjects care about not been identified as liars, it is mainly for strategic reasons, to avoid punishment.

We remain cautious about the external validity of our findings since our experiment did not involve real actors in financial markets, and lying in the lab is not illegal or in violation of professional codes. However, Egan et al. (2019) showed a high level of fraud despite actors having a fiduciary duty towards investors. Our experiment reveals a high frequency of deniable lies in all settings, even though getting caught lying is not illegal. This is concerning for what it implies for markets outside the lab: if there is such a high level of deniable lying when lying is not illegal and subjects can make detectable lies with no "long term" consequences, the implication is that such lies may be very prevalent outside the lab as well. A major challenge is to discourage deniable lying. Our findings call both for the development of incentive schemes that increase the personal responsibility and accountability of financial advisers, more traceability, internal codes of ethics and more centralized investigations and sanctions in case of detected fraud. As claimed in Greenspan (2007), *"An area in which more rather than less government involvement is needed, in my judgment, is the rooting out of fraud. It is the bane of any market system."* (p.375).

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ONLINE APPENDIX

A Instructions

Below we present the instructions that the subjects received in our experiment (translated from French).

INTRODUCTION (All treatments)

Welcome to this experiment on decision-making. Please switch off your mobile phone and store it. You are not allowed to communicate with the other participants throughout the experiment, or we must exclude you from the experiment and from payments.

This session consists of four successive parts. The first two parts are linked but the other parts are independent. The amount earned at the end of the session is the sum of your earnings in the different parts. During the session we do not speak in Euros but in tokens. The conversion rate of tokens into Euros is:

100 tokens = 5 Euros

At the end of the session, your total earnings will be paid to you in cash and confidentially in a separate room.

All the decisions you will make in the session are anonymous: you will never have to enter your name in the computer.

You have received the instructions for the fist part. You will receive the instructions for each part after completing the previous part.

PART 1 (All treatments)

This part consists in 17 periods. The first 16 periods are practice periods and nothing that you will decide in these periods will count for determining your payoff. The only period that counts for your payoff in this part is the 17th (and last) period. We describe below the rules and the task, but for the 16 practice periods the announced payoffs are hypothetical.

(In the No Information treatment, this paragraph was replaced with this one: This part consists in 18 periods. The first 16 periods are practice periods and nothing that you will decide in these periods will count for determining your payoff. The only periods that count for your payoff in this part are the 17th and the 18th (and last) periods. At the end of the session the program will randomly select period 17 or period 18 and your payoff in the selected period will constitute your payoff for this part. Each of these two periods has 50 chances out of 100 to be drawn. We describe below the rules and the task, but for the 16 practice periods the announced payoffs are hypothetical.)

Description of the task

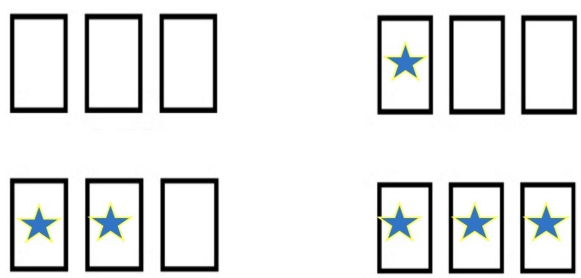
In each period, you receive an initial endowment of 100 tokens and you have to decide between keeping these tokens as the payoff of the period, or to invest them entirely in a project. If this project is a success, you earn three times the number of tokens invested, *i.e.*, 300 tokens. If this project is not a success, you earn 30 tokens.

Description of the investment project

In each period, 3 cards appear on your screen, face down. Each can hide the star symbol or be blank. Each card has 50 chances out of 100 to represent a star and 50 chances out of 100 to be blank. These chances are independent for each card.

Thus, your 3 cards can hide in total no star (which happens with 12.5 chances out of 100), in total 1 star (which happens with 37.5 chances on 100), in total 2 stars (what happens with 37.5 chances on 100), or in total 3 stars (which happens with 12.5 chances out of 100).

You have to press the "Reveal" button to discover your three cards. Depending on the case, the cards will always appear in the following format:



After revealing them, you have to choose whether you invest or not your 100 tokens. After you have made your choice, the program draws one of your three cards, each card having the same chance of being drawn (so, each card has a 1 in 3 chance of being selected).

- If the drawn card represents a star and you have invested, the project is a success and you earn 300 tokens (that is, the endowment of 100 - the investment of 100 + the gain of 300).
- If the drawn card is blank and you have invested, the project is not a success and you earn 30 tokens (that is, the endowment of 100 - the investment of 100 + the winning of 30).

If you have not invested your tokens, you keep your initial endowment of 100 tokens, thus you earn 100 tokens.

Whatever your choice, you are informed at the end of the period if the card drawn by the program among the three cards represents or not a star.

Remember that in these 16 practice periods, these payoffs are hypothetical and nothing that you decide in these periods counts to determine your actual payoff.

In addition, to ensure that you have met all possible scenarios, we have previously selected cases that correspond to the probabilities announced in the task description above.

Period 17

Period 17 determines your actual payoff for this part. The rules and the task are the same as in the previous 16 periods. The only difference is in the way you have to make your investment choice.

(*In the No Information treatment, the first sentence was replaced with this one: If it is randomly selected at the end of the session, period 17 determines your actual payoff for this part.)*

Your screen will reveal three cards, face down. Each card has 50 chances out of 100 to hide a star.

In this period, you have to make a decision in each of the following four scenarios. Would you invest or not in the project if the program revealed that among the three cards, there are:

- Scenario a) 0 stars?
- Scenario b) 1 star?
- Scenario c) 2 stars?
- Scenario d) 3 stars?

Once you have answered these questions, the program will inform you of the total number of stars among your three cards.

Your payoff

Your payoff is determined by the answer to the applicable scenario, that is, the one that corresponds to the total number of stars among your three cards. For example, suppose the three cards hide a total of two stars; in this case, it is your decision in scenario (c) that applies. Another example: suppose the three cards hide a total of three stars; in this case, it is your decision in scenario (d) that applies.

The program then draws one of your three cards.

- If you have invested in the project and the drawn card is a star, then you earn 300 tokens (endowment of 100 - investment of 100 + gain of 300).
- If you have invested in the project and the draw card is blank, then you earn 30 tokens (endowment of 100 - investment of 100 + gain of 30).
- If you did not invest, you earn the 100 tokens from your initial endowment.

As you can see, the principle is the same as the one that applies in the 16 practice periods, but here you make a decision in every possible scenario.

Since only one of your answers will count to determine your payoff, when you make your decision in each scenario it is in your interest to treat each scenario as if it were the one that actually counts for determining your payoff in this part. You will be informed of the draw and your payoff in this part at the end of the session.

(In the No Information treatment, the last paragraph was replaced with this one: Since only one of your answers will count to determine your payoff if this period is randomly selected for payment, when you make your decision in each scenario it is in your interest to treat each scenario as if it were the one that actually counts for determining your payoff in this part.)

(In the No Information treatment only) **Period 18**
If it is randomly selected at the end of the session, period 18 determines your actual payoff for this part. Like in the previous periods your screen will reveal three cards, face down. Each card has 50 chances out of 100 to hide a star. You have to decide again about whether you invest or not in the project. However, in contrast with the previous periods, you have to make a single decision without being informed on the number of cards with a star. It is only at the end of the session that the program will inform you of the total number of stars among your three cards.

Your payoff
If this period 18 is randomly drawn for payment, your payoff is determined as follows:

- *If you have invested in the project and the drawn card is a star, then you earn 300 tokens.*
- *If you have invested in the project and the draw card is blank, then you earn 30 tokens.*
- *If you did not invest, you earn the 100 tokens from your initial endowment.*

You will be informed of the period selected (17 or 18), the card drawn and your payoff in this part at the end of the session.

(All treatments) Please read again these instructions carefully. Whenever you have a question, please raise your hand or press the red button on the side of your desk. We will come immediately to your desk and answer to your question in private.

PART 2 (Random Pairs and Fixed Pairs treatment)

In this part, each of you will be assigned a role, either A or B. Half of the participants have role A and the other half have role B. Your role remains the same throughout part 2: you will never change role.

Part 2 has a **minimum** of 20 periods and a **maximum** of 40 periods. The exact number of periods was determined before the start of the session.

In each period, each of you is paired so that there is one participant A and one participant B in each pair. You will never know the identity of the people with whom you will be matched. At the beginning of each period, **you are re-paired with a new participant**. Given the number of participants in this session, it is highly unlikely that you will be paired with the same other participant several times in a row.

(*In the Fixed Pairs treatment the previous last two sentences were replaced with these ones:* ***Your pair remains the same during all the periods: you interact with the same participant throughout this part.***)

Your task in each period

Participant A: Participant A can see three cards on his/her screen, face down. Each card can represent the star symbol ($\star$) or be blank. Each card has 50 chances out of 100 to represent a star and 50 chances out of 100 to be blank. These chances are independent for each card. Thus, the participant A can have in total 0 star, 1 star, 2 stars or 3 stars. Participant A has the opportunity to see how many stars s/he has by pressing the "Reveal" button.

Participant A's task has then to announce his/her total number of stars to the participant B with whom s/he is paired. Participant B cannot see participant A's cards at any time.

Participant B: Participant B receives an initial endowment of 100 tokens and is informed of the announcement of the participant A with whom s/he is matched on his/her number of stars. Participant B has to decide if s/he is willing to keep his/her tokens or invest them in participant A's project.

Determination of payoffs

If you are a participant A: You earn a fixed amount of 30 tokens, plus 200 tokens if the participant B has invested in your project.

If you are a participant B: Once you have made your investment decision, the program draws one of the three cards of the participant A.

- If you have invested in the project and the drawn card represents a star, the project is a success and you earn 300 tokens (that is, endowment of 100 - investment of 100 + gain of 300).
- If you have invested in the project and the drawn card is blank, the project is not a success and you earn 30 tokens (that is, endowment of 100 - investment of 100 + gain of 30).
- If you did not invest, you earn 100 tokens from your initial endowment.

Whatever your choice, you are informed at the end of the period if the card drawn by the program among the three cards represents or not a star.

Your screen

On your screen will be a history box where you can see what happened in previous periods. Specifically, you will see four types of information:

(1) your announcements in the previous periods, if you are a participant A, or the announcements of the different participants A with whom you were matched, if you are a participant B;

(2) whether the card drawn in the previous periods represented a star or not, regardless of your role and your decision;

(3) if you have invested in previous periods, if you are a participant B, or if the participants B with whom you were matched have invested or not, if you are a participant A.

(4) your potential payoff in each previous period.

(*In the Fixed Pairs treatment the previous sentences were replaced with these ones:*

(1) your announcements in the previous periods, if you are a participant A, or the announcements of the participant A, if you are a participant B;

(2) whether the card drawn in the previous periods represented a star or not, regardless of your role and your decision;

(3) if you have invested in previous periods, if you are a participant B, or if the participant B has invested or not, if you are a participant A.

(4) your potential payoff in each previous period.)

A scroll bar will allow you to scroll through all previous periods.

For each of you, only one period has already been drawn by the program for payment and it is your decision in this period that will help determine your payoff for this part. Thus, it is in your interest to make your decisions in each period as if it was that period that counted to determine your payoff of the part.

Remember that pairs are rematched in each new period.
(*In the Fixed Pairs treatment the previous sentence was replaced with this one: Remember that pairs are fixed for the entire part.*)

Please read again these instructions. Whenever you have a question, please raise your hand or press the red button. We will immediately answer to your question in private.

PART 2 (Random Triplets, Fixed Triplets and Infinite treatments)

In this part, each of you will be assigned a role, either A or B. Two-thirds of the participants have role A and one third have role B. Your role remains the same throughout part 2: you will never change role.

Part 2 has a **minimum** of 20 periods and a **maximum** of 40 periods. The exact number of periods was determined before the start of the session.

(*In the Infinite treatment the previous paragraph was replaced with this one: Part 2 has a **minimum** of 20 periods. At the end of period 20 and of each following period there are 85 chances out of 100 that a new period starts. Thus, you do not know the exact number of periods in this part.*)

In each period, each of you is matched in a group of three so that there are two participants A (A1 and A2) and one participant B in each group. You will never know the identity of the people with whom you will be matched. At the beginning of each period, **you are rematched with two new participants**. Given the number of participants in this session, it is highly unlikely that you will be matched with the same two other participants several times in a row.

(*In the Fixed Triplets and the Infinite treatments the previous last two sentences were replaced with these ones:* ***Your group remains the same during all the periods: you interact with the same two participants throughout this part.***)

Your task in each period

Participants A: Each participant A in the group can see three cards on his/her screen, face down. Each card can represent the star symbol ($\star$) or be blank. Each card has 50 chances out of 100 to represent a star and 50 chances out of 100 to be blank. These chances are independent for each card. Thus, each participant A can have in total 0 star, 1 star, 2 stars or 3 stars. Each participant A has his/her own set of three cards and therefore each has an independent chance to have a total of 0, 1, 2 or 3 stars. Each participant A has the opportunity to see how many stars s/he has by pressing the "Reveal" button.

Each participant A's task is then to announce his/her total number of stars to the participant B in the group. A participant A cannot see the cards of the other participant A and the participant B cannot see the cards of any participant A at any time.

Participant B: Participant B receives an initial endowment of 100 tokens and is informed of the announcements of the two participants A in the group on their number of stars. Participant B has to decide if s/he is willing to keep his/her tokens or invest them in one of the two projects of the participants A, either A1's project or A2's project (it is not possible to invest in both projects) .

Determination of payoffs

If you are a participant A: You earn a fixed amount of 30 tokens, plus 200 tokens if the participant B has invested in your project.

If you are a participant B: Once you have made your investment decision, the program draws one of the three cards of each participant A.

- If you have invested in a project and the drawn card for this project represents a star, the project is a success and you earn 300 tokens (that is, endowment of 100 - investment of 100 + gain of 300).
- If you have invested in a project and the drawn card for this project is blank, the project is not a success and you earn 30 tokens (that is, endowment of 100 - investment of 100 + gain of 30).
- If you did not invest, you earn 100 tokens from your initial endowment.

Whatever your choice, you are informed at the end of the period if the card drawn by the program among the three cards represents or not a star.

Your screen

On your screen will be a history box where you can see what happened in previous periods. Specifically, you will see four types of information:

(1) your announcements in the previous periods and those of other participants A you were matched with if you are a participant A, or the announcements of each of the participants A with whom you were matched, if you are a participant B;

(2) whether the card drawn in the previous periods for each participant A with whom you we matched represented a star or not, regardless of your role and your decision;

(3) if you have invested and with which participant As you were matched with in previous periods, if you are a participant B, or if the participants B with whom you were matched have invested or not and with which participant As, if you are a participant A.

(4) your potential payoff in each previous period.

(*In the Fixed Triplets and the Infinite treatments the previous sentences were replaced with these ones:*

(1) your announcements in the previous periods and those of the other participant A if you are a participant A, or the announcements of each of the two participants A, if you are a participant B;

(2) whether the card drawn in the previous periods for each participant A represented a star or not, regardless of your role and your decision;

(3) if you have invested and with which participant A in previous periods, if you are a participant B, or if the participants B has invested or not and with which participant A, if you are a participant A.

(4) your potential payoff in each previous period.)

A scroll bar will allow you to scroll through all previous periods.

For each of you, only one period has already been drawn by the program for payment and it is your decision in this period that will help determine your payoff for this part. Thus, it is in your interest to make your decisions in each period as if it was that period that counted to determine your payoff of the part.

(*In the Infinite treatment the previous last paragraph was replaced with this one: For each of you, only one period will be randomly drawn by the program for payment and it is your decision in this period that will help determine your payoff for this part. If this part lasts for more than 20 periods,* ***there are 3 chances out of 4 that one of the first 20 periods will be randomly drawn for payment, and 1 chance out of 4 that it is a period after the 20th period that will be drawn for payment.*** *Thus, it is in your interest to make your decisions in each period as if it was that period that counted to determine your payoff of the part.*)

Remember that pairs are rematched in each new period. (*In the Fixed Triplets and Infinite treatment the previous sentence was replaced with this one: Remember that pairs are fixed for the entire part.*)

Please read again these instructions. Whenever you have a question, please raise your hand or press the red button. We will immediately answer to your question in private.

PART 2 (No Communication Fixed Pairs treatment)

In this part, each of you will be assigned a role, either A or B. Half of the participants have role A and the other half have role B. Your role remains the same throughout part 2: you will never change role.

Part 2 has a **minimum** of 20 periods and a **maximum** of 40 periods. The exact number of periods was determined before the start of the session.

In each period, each of you is paired so that there is one participant A and one participant B in each pair. You will never know the identity of the people with whom you will be matched. **Your pair remains the same during all the periods: you interact with the same participant throughout this part.**)

Your task in each period

Participant A: Participant A can see three cards on his/her screen, face down. Each card can represent the star symbol ($\star$) or be blank. Each card has 50 chances out of 100 to represent a star and 50 chances out of 100 to be blank. These chances are independent for each card. Thus, the participant A can have in total 0 stars, 1 star, 2 stars or 3 stars. Participant A has the opportunity to see how many stars s/he has by pressing the "Reveal" button.

Participant A has no task to perform. Participant B cannot see participant A's cards at any time.

Participant B: Participant B receives an initial endowment of 100 tokens and s/he has to decide if s/he is willing to keep his/her tokens or invest them in participant A's project. S/He is not informed of the number of stars on the cards of the participant A with whom s/he is matched.

Determination of payoffs

If you are a participant A: You earn a fixed amount of 30 tokens, plus 200 tokens if the participant B has invested in your project.

If you are a participant B: Once you have made your investment decision, the program draws one of the three cards of the participant A.

- If you have invested in the project and the drawn card represents a star, the project is a success and you earn 300 tokens (that is, endowment of 100 - investment of 100 + gain of 300).
- If you have invested in the project and the drawn card is blank, the project is not a success and you earn 30 tokens (that is, endowment of 100 - investment of 100 + gain of 30).
- If you did not invest, you earn 100 tokens from your initial endowment.

Whatever your choice, you are informed at the end of the period if the card drawn by the program among the three cards represents or not a star.

Your screen

On your screen will be a history box where you can see what happened in previous periods. Specifically, you will see four types of information:

(1) whether the card drawn in the previous periods represented a star or not, regardless of your role and your decision;

(2) if you have invested in previous periods, if you are a participant B, or if the participant B has invested or not, if you are a participant A.

(3) your potential payoff in each previous period.
A scroll bar will allow you to scroll through all previous periods.

For each of you, only one period has already been drawn by the program for payment and it is your decision in this period that will help determine your payoff for this part. Thus, it is in your best interest to make your decisions in each period as if it was that period that counted to determine your payoff of the part.

Remember that pairs are fixed for the entire part.)

Please read again these instructions. Whenever you have a question, please raise your hand or press the red button. We will immediately answer to your question in private.

PART 3 (Random Pairs, Fixed Pairs and No Communication treatments)

This part is independent of the previous parts.

In this part, there are two roles: participant X and participant Y. There is the same number of participants X and participants Y. The part consists of 15 periods.

At the beginning of each period, the program randomly matches each participant X with a new participant Y. Only participant X makes decisions that determine both his/her payoff and that of participant Y.

(*In the Fixed Pairs and No Communication treatments the previous paragraph was replaced with this one: At the beginning of the first period and for the whole part, the program randomly matches each participant X with a participant Y. Only participant X makes decisions that determine both his/her payoff and that of participant Y.*)

At the beginning of the part, the program randomly assigns you one of two roles for the entire part, regardless of your role in the previous part. However, you will only be informed of your role at the end of the session. During the part, **you will all make decisions in the role of a participant X**.

If at the end of the session you learn that the program has assigned you the role of a participant Y, none of the decisions you have made will count. Your decisions will count only if the program has assigned you the role of a participant X.

In each period, in the role of participant X you have to choose between two payoff options for you and for participant Y. Here is an example of choices that are presented to you (the actual choices are different from this example):

Option 1: (50, 100) Option 2: (100, 80)

The first number in parentheses is always participant X's payoff and the second number is always participant Y's payoff. In the example above, assuming the period is drawn for payment, option 1 pays you 50 tokens and 100 tokens for participant Y; option 2 pays you 100 tokens and 80 tokens for participant Y.

In each period, you make the same type of decision. Once you have made your decisions in all periods, you will be informed about the period previously drawn for payment by the program. Given your actual role, it is your decision or that of the other participant with whom you are matched in this period that will determine your payoff.

Please read again these instructions. Whenever you have a question, please raise your hand or press the red button. We will immediately answer to your question in private.

PART 3 (Random Triplets, Fixed Triplets and Infinite treatments)

This part is independent of the previous parts.

In this part, there are three roles: participant X, participant Y, and participant Z. There is one third of participants X, one third of participants Y, and one third of participants Z. The part consists of 18 periods.

At the beginning of each period, the program randomly matches each participant X is with a new participant Y and a new participant Z. Only participant X makes decisions that determine both his/her payoff and that of participants Y and Z.

(*In the Fixed Triplets and the Infinite treatments the previous paragraph was replaced with this one: At the beginning of the first period and for the whole part, the program randomly matches each participant X with a participant Y and a participant Z. Only participant X makes decisions that determine both his/her payoff and that of participants Y and Z.*)

At the beginning of the part, the program randomly assigns you one of the three roles for the entire part, regardless of your role in the previous part. However, you will only be informed of your role at the end of the session. During the part, **you will all make decisions in the role of a participant X**.

If at the end of the session you learn that the program has assigned you the role of a participant Y or a participant Z, none of the decisions you have made will count. Your decisions will count only if the program has assigned you the role of a participant X.

In each period, in the role of participant X you have to choose between two payoff options for you and for participants Y and Z. Here is an example of choices that are presented to you (the actual choices are different from this example):

Option 1: (50, 100, 110) Option 2: (100, 70, 80)

The first number in parentheses is always participant X's payoff, the second number is always participant Y's payoff, and the third number is always participant Z's payoff. In the example above, assuming the period is drawn for payment, option 1 pays you 50 tokens, 100 tokens for participant Y and 110 tokens for participant Z; option 2 pays you 100 tokens, 70 tokens for participant Y and 80 tokens for participant Z.

In each period, you make the same type of decision. Once you have made your decisions in all periods, you will be informed about the period previously drawn for payment by the program. Given your actual role, it is your decision or that of one of the two other participants with whom you are matched in this period that will determine your payoff.

Please read again these instructions. Whenever you have a question, please raise your hand or press the red button. We will immediately answer to your question in private.

PART 4 (All treatments)

You will see 20 statements about personality characteristics on your screen. Please indicate for each statement how much you agree or disagree with these statements. Choose the number that corresponds the most to your opinion.

1. Strongly Disagree
2. Disagree
3. Slightly Disagree
4. Neutral
5. Slightly Agree
6. Agree
7. Strongly Agree

- Never tell anyone the real reason you did something, unless it is useful to do so.
- The best way to handle people is to tell them what they want to hear.
- One should take action only when sure it is morally right.
- Most people are basically good and kind.
- It is safest to assume that all people have a vicious streak, and it will come out when they are given a chance.
- Honesty is the best policy in all cases.
- There is no excuse for lying to someone else.
- Generally speaking, people won't work hard unless they are forced to do so.
- All in all, it is better to be humble and honest than to be important and dishonest.
- When you ask someone to do something for you, it is best to give the real reasons for wanting it rather than giving reasons which carry more weight.
- Most people who get ahead in the world lead clean, moral lives.
- Anyone who completely trusts anyone else is asking for trouble.
- The biggest difference between most criminals and other people is that the criminals are stupid enough to get caught.
- Most people are brave.
- It is wise to flatter important people.

- It is possible to be good in all respects.
- P.T. Barnum was wrong when he said that there is a sucker born every minute.
- It is hard to get ahead without cutting corners here and there.
- People suffering from incurable diseases should have the choice of being put painlessly to death.
- Most people forget more easily the death of their parents than the loss of their property.

B Proofs of Theorem 2

Proof. Consider the following possible equilibrium for a game of duration T.

1. The investor invests with the project manager who announces the highest number of stars for the first k periods so long as that number is greater than 0 stars, and randomly chooses a PM if they both announce the same number of stars.
2. For all periods $> k$, both project managers babble and the investor invests exclusively with the PM who is the most likely to have told the truth over the course of the first k periods.

Let us introduce the following point system:

- If the PM announced 0 stars: if a star is drawn, he gets -infinity points, otherwise he gets 1 point.
- If the PM announced 3 stars: if no star is drawn he gets -infinity points, otherwise he gets 1 point.
- If the PM announced 1 star: if a star is drawn, he gets 0 points; if no star is drawn he gets 1 point.
- If the PM announced 2 stars: if no star is drawn he gets 0 points; if a star is drawn, he gets 1 point.

We show that given PM2 is telling the truth, PM1 is worse off if he deviates. The tension that exists is that announcing a higher number than the truth leads to a higher chance of an immediate benefit (it raises the chances that the investor will invest with PM1), but comes at the cost of lowering the chances that PM1 will be chosen after the k periods.

We prove the above by showing that an equilibrium where PMs tell the truth in period 1 and then babble can be supported.

PM1 observes 1 star

Suppose he tells the truth:

<u>Immediate return:</u> Here we consider the chances that the investor will invest with PM1. With 12.5% chance he gets the investment (12.5% is the probability that PM2 has 0 stars), with 37.5% chance he has a 50% chance of getting the investment (37.5% is the probability that PM2 also has 1 star),

and with 50% chance he doesn't get the investment (50% is the probability that PM2 has 2 or 3 stars). In expectation he earns: 0.125*230+.375*.5*230 = 71.875.
<u>Future return:</u> How much PM1 receives for the remaining periods depends on the number of points he collects relative to PM2. How many points does PM2 get?

- With 25% chance, PM2 has 0 or 3 stars and so receives 1 point for sure.
- With 75% chance, PM2 has 2/3 chances of getting 1 point and 1/3 chances of getting no points.

  $\rightarrow$ overall PM2 has a 75% chance of getting 1 star and a 25% chance of getting 0 stars.

How many points does PM1 get?

- with 2/3 chances, PM1 receives 1 point.
- with 1/3 chance, PM1 receives no points.

PM1 has a 50% chance of being chosen for all remaining periods if he and PM2 either both have 0 points (1/12 chance) or both have 1 point (50% chance). PM1 is chosen for all remaining periods for sure if he has 1 point and PM2 has none (1/6 chances), and PM1 is not chosen if he has 0 points and PM2 has 1 (25% chance).

The overall expected return of telling the truth is therefore:

$$71.875 + \frac{11 \times 230}{24} \times (T - 1) \tag{1}$$

Suppose he lies and announces 2 stars:
<u>Immediate return:</u> With probability 50% he receives the investment (50% is the probability that the other PM announces 0 or 1 stars) today and earns 230 tokens. With 37.5% PM2 announces 2 stars and PM1 has a half chance of receiving the investment. With 12.5% chance PM2 announces 3 stars and PM1 does not receive the investment and earns 0. This lie earns him 158.125 tokens in expectation.
<u>Future return:</u> How much PM1 receives for the remaining periods depends on the number of points he collects relative to PM2. The number of points PM2 gets is the same as if PM1 told the truth. How many points does PM1 get?

- with 2/3 chances, PM1 receives no points.
- with 1/3 chance, PM1 receives 1 point.

PM1 has a 50% chance of being chosen for all remaining periods if he and PM2 either both have 0 points (1/6 chance) or both have 1 point (25% chance). PM1 is chosen for all remaining periods for sure if he has 1 point and PM2 has none (1/12 chances), and PM1 is not chosen if he has 0 points and PM2 has 1 (50% chance).

The overall expected return of announcing 2 stars instead of telling the truth is:

$$158.125 + \frac{7 \times 230}{24} \times (T - 1) \tag{2}$$

Is it worth is? A simple comparison of Equations (1) and (2) shows that so long as there are more than 2 periods left, PM1 is better off telling the truth than announcing 2 stars.

Suppose he lies and announces 3 stars:

Immediate return: Let's look at the benefit of this deviation. With probability 87.5% he receives the investment (87.5% is the probability that the other PM announces 0, 1 or 2 stars) today and earns 230 tokens. With 12.5% PM2 announces 3 stars too and PM1 has a half chance of receiving the investment. This lie earns him 215.625 tokens in expectation.

Future return: How much PM1 receives for the remaining periods depends on the number of points he collects relative to PM2. The number of points PM2 gets is the same as if PM1 told the truth. How many points does PM1 get?

- with 2/3 chances, PM1 receives $-\infty$ points.
- with 1/3 chance, PM1 receives 1 point.

PM1 has a 50% chance of being chosen for all remaining periods if he and PM2 either both have 1 point (25% chance). PM1 is chosen for all remaining periods for sure if he has 1 point and PM2 has none (1/12 chances), and PM1 is not chosen if he has $-\infty$ points (2/3 chance).

The overall expected return of announcing 3 stars instead of telling the truth is:

$$215.625 + \frac{5 \times 230}{24} \times (T - 1) \tag{3}$$

Is it worth is? A simple comparison of Equations (1) and (3) shows that so long as there are more than 2 periods left, PM1 is better off telling the truth than announcing 2 stars.

Given that downward lying provides no incentive in terms of immediate or future returns, we have shown that if PM1 observes 1 star, he is better off telling the truth so long as there are at least 2 periods left in the game. The proof in other scenarios (PM1 observes 0, 2 or 3 stars) follows the same logic (the details of these derivations are available upon request).

This shows how truth-telling in period 1 can be supported. It obviously follows that truth-telling in more than 1 period can be supported so long as there are enough periods left in the game so that the lure of future returns outweighs the lure of an immediate return.

□

C The Allocation Game

Table C1: The Allocation Game

Treatments	Random and Fixed Pairs		Random and Fixed Triplets	
Decision	Option 1	Option 2	Option 1	Option 2
1	(30,100)	(100,30)	(80,100,100)	(100,100,80)
2	(0,0)	(40,30)	(0,0,0)	(40,30,30)
3	(30,30)	(60,60)	(30,30,30)	(60,60,60)
4	(80,60)	(70,100)	(80,60,60)	(70,100,100)
5	(100,30)	(30,230)	(100,30,30)	(30,230,30)
6	(70,60)	(90,80)	(70,60,60)	(90,80,80)
7	(100,30)	(300,230)	(100,30,30)	(300,230,30)
8	(70,60)	(90,50)	(70,60,60)	(90,50,50)
9	(30,30)	(30,300)	(30,30,30)	(30,300,300)
10	(60,50)	(90,40)	(60,50,50)	(90,40,40)
11	(100,30)	(30,230)	(100,30,30)	(30,230,230)
12	(230,30)	(100,230)	(230,30,30)	(100,230,230)
13	(60,60)	(50,20)	(60,60,60)	(50,30,30)
14	(230,230)	(300,230)	(230,230,230)	(300,230,230)
15	(60,70)	(50,20)	(60,70,70)	(50,20,20)
16	-	-	(60,40,30)	(90,30,30)
17	-	-	(70,50,60)	(70,50,100)
18	-	-	(60,50,50)	(100,70,60)

Notes: In parentheses, the first number is the payoff of X, the second number the payoff of Y and the third number the payoff of Z. The first two columns display the pairs of options used in the Random and Fixed Pairs treatments; the last two columns display the pairs of options used in the Random and Fixed Triplets treatments.

D Intensive and Extensive Lies

Table D1 is similar to Table 3 except here we take all the data into account (as opposed to restricting it to project managers who lie at least once). The patterns of data as well as conclusions of the main text apply here as well.

Table D1: A Typology of Lies – Intensive and Extensive Margins

Treatments	Random Pairs	Fixed Pairs	Random Triplets	Fixed Triplets
Intensive Margin				
Extreme Lies	25.0%	1.4%	28.3%	1.8%
High Risk Lies	25.6%	2.5%	33.1%	3.4%
Low(er) Risk Lies	34.6%	16.3%	49.1%	16.7%
Deniable Lies	43.4%	45.5%	46.7%	47.2%
Extensive Margin				
Extreme Lies	39.5%	2.7%	49.3%	6.6%
High Risk Lies	52.1%	12.8%	73.1%	21.8%
Low(er) Risk Lies	64.3%	48.7%	85.9%	50.0%
Deniable Lies	81.4%	94.9%	85.9%	88.5%
Detectable Lies	69.0%	48.7%	89.7%	55.1%

Note: The intensive margin is given by the fraction of times subjects make lies in each treatment, conditioned on the true observed number of stars. The extensive margin is given by the fraction of subjects who engage in each type of lies at least once.

E Appendix Figures

Figure E1 displays the evolution of the relative frequency of lies, by treatment. Figures E2 and E3 display the evolution of the proportion of Investors who invest over time, by treatment.

Figure E1: Evolution of the Relative Frequency of Lies, by Treatment

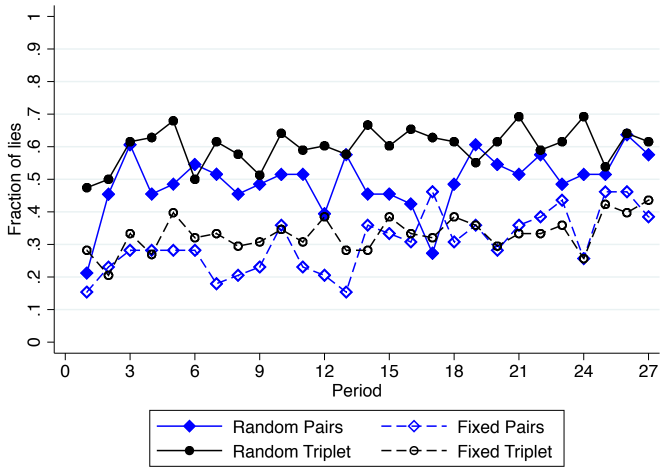


Figure E2: Evolution of the Relative Frequency of Investment, in the Pairs Treatments

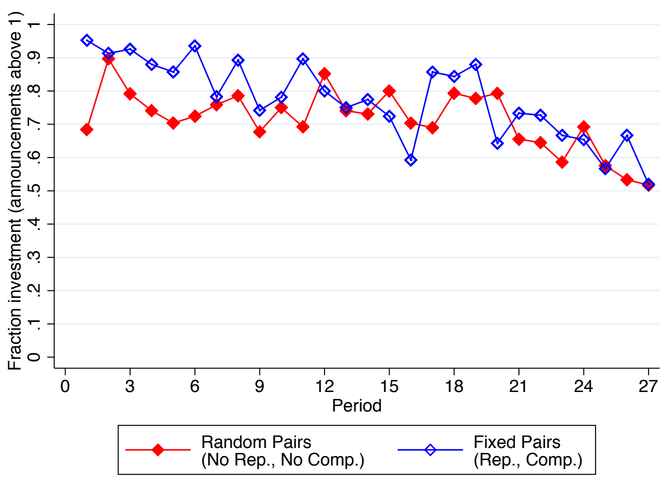
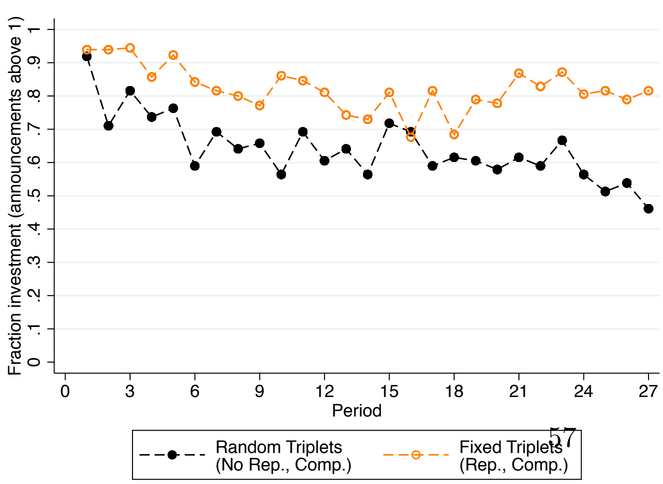


Figure E3: Evolution of the Relative Frequency of Investment, in the Triplets Treatments



F Errors in Investment Decisions Across Treatments

Below we report treatment differences in two types of errors that asymmetric information generates. Type 1 errors describe periods in which investors do not invest, but would if they believed the announcement. Type 2 errors describe periods in which investors invest, but would not if they knew the true number of stars the PM faced. To determine whether a choice is a mistake or not, we look at whether the choice in the Investment Game is consistent with that in the Simplified Investment Game where announcements are truthful by design. Table E1 reports the average fraction of periods investors make Type 1 and Type 2 errors. We show these numbers for all periods without conditioning, as well as conditioning on no investment for the Type 1 errors and on investment happening for the Type 2 errors.

Table E1: Type 1 and Type 2 Errors, by Treatment

Treatments	Random Pairs	Fixed Pairs	Random Triplets	Fixed Triplets
All Periods				
Type 1 Errors	23.9%	16.9%	32.5%	16.5%
Type 2 Errors	21.4%	16.5%	19.4%	19.6%
Periods with Errors	45.3%	33.4%	51.9%	36.1%
Conditional				
Type 1 Errors	60.8%	39.9%	89.1%	74.7%
Type 2 Errors	35.3%	28.7%	30.5%	25.1%

Notes: This Table reports the average fraction of periods an investor faces a given type of error. Type 1 errors occur when investors do not invest while they would if they had believed the announcement; Type 2 errors occur when investors invest while they would not have if they knew the true number of stars. For conditional values, these fractions are based on Type 1 errors occurring in the sole periods where investment does not happen, and on Type 2 errors occurring in the sole periods where investment happens.

Table E1 shows that both Type 1 and Type 2 errors are common. For example, in the Random Pairs treatment Type 1 errors happen in 23.9% of periods. That is, in close to 1 in 4 periods they miss out on good opportunities (in their eyes). Type 2 errors occur in 21.4% of periods in this treatment. Thus, in more than 1 in 5 periods investors are the victims of fraudulent announcements. These numbers are even more staggering if we look at the conditional fractions: 60.8% of non-investments are missed opportunities and 35.3% of investments are the result of fraudulent announcements in this treatment. Note that the fraction of mistakes across periods is at least a third in all treatments. Asymmetric information leads to a high level of mistakes, even in the presence of reputation. Under competition Type 1 errors are more frequent than in the Pairs treatments, especially in the absence of reputation and this is the result of the particularly high proportion of investors who exit the market permanently in this treatment.

G Regression Analyses

The regressions in Table F1 confirm the results from the non-parametric tests we report in the main body of the paper about PMs' behavior. This Table reports the estimates of coefficients from Probit models with standard errors clustered at the individual level. In models (1) and (2) the dependent variable is making a detectable lie (Extreme, High Risk and Low(er) Risk lies). In models (3) and (4) the dependent variable is making a deniable lie. The independent variables include the various treatments, with the Random Pairs treatment as the omitted category, as well as a time trend. Models (1) and (3) also control for individual characteristics (number of efficient choices in the Allocation Game, Machiavellian score and gender). These regressions confirm that detectable lies are less frequent in the presence of reputation (regressions 1 and 2), but there are no treatment differences when it comes to Deniable lies (models 3 and 4). This is the case whether or not we use controls. While not reported in detail here, none of the controls are significant.

Table F1: Treatment Differences in the Likelihood of Making Detectable and Deniable Lies.

	(1)	(2)	(3)	(4)
Fixed Pairs	-1.168 (0.247)***	-1.186 (0.248)***	-0.069 (0.130)	-0.054 (0.130)
Random Triplets	0.261 (0.207)	0.272 (0.202)	-0.031 (0.131)	-0.004 (0.130)
Fixed Triplets	-1.071 (0.216)***	-1.065 (0.212)***	0.049 (0.123)	0.061 (0.124)
Period	0.008 (0.005)*	0.008 (0.005)*	0.010 (0.002)***	0.010 (0.003)***
Constant	-1.091 (0.437)**	-0.790 (0.188)***	-1.080 (0.290)***	-0.886 (0.119)***
Controls	Yes	No	Yes	No
Number of observations	5,859	5,859	5,859	5,859
Number of groups	217	217	217	217

Notes: This Table presents the coefficients from panel Probit regressions of making a detectable lie (models 1 and 2) or a deniable one (models 3 and 4) on treatment dummies. The omitted dummy is the Random Pairs treatment. In models 1 and 3 controls include the number of efficient choices in the Allocation Game, the Machiavellian score as well as gender. Standard errors are clustered at the individual level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

The regressions in Table F2 also confirm the results from the non-parametric tests we report in the main body of the paper about investors' behavior. This Table reports the estimates of coefficients from Probit models with standard errors clustered at the individual level. The dependent variable is the binary decision of the investor to invest. The independent variables include the various treatments, with the Random Pairs treatment as the omitted category, having detected a lie in the previous period and the announcement in the current period. Model (1) also controls for individual characteristics (number of efficient choices in the Allocation Game, Machiavellian score and gender). These regressions show that the Fixed Triplets treatment sees higher investment than the others. Indeed, relative to Random Pairs, the likelihood of investing is higher in Fixed Triplets, while compared with the control, investment is no different in Fixed Pairs and is actually lower in

Random Triplets (although the significance of this last comparison is marginal and sensitive to the inclusion of controls). Not surprisingly, the likelihood of investing is significantly higher when the announcement is higher, and it is lower after a detected lie.

Table F2: Treatment Differences in the Likelihood of Investing.

	(1)	(2)
Fixed Pairs	0.124 (0.199)	0.183 (0.192)
Random Triplets	-0.454 (0.256)*	-0.427 (0.264)
Fixed Triplets	0.456 (0.219)**	0.534 (0.211)**
Period	-0.029 (0.004)***	-0.029 (0.004)***
Detected lie in $t-1$	-0.453 (0.081)***	-0.454 (0.081)***
Announcement	1.237 (0.082)***	1.20 (0.078)***
Constant	-1.587 (0.572)***	-1.818 (0.206)***
Controls	Yes	No
Number of observations	4,134	4,134
Number of groups	159	159

Notes: This Table presents the coefficients from panel Probit regressions of investing. In the Triplets treatments, "Announcement" corresponds to the highest announcement. In model (1) controls include the number of efficient choices in the Allocation Game, the Machiavellian score as well as gender. Standard errors are clustered at the individual level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

The regressions in Table F3 report the estimates of coefficients from Probit models with standard errors clustered at the individual level. The dependent variable is having lied at least once in the Investment Game. The regressions in Table F4 report the estimates of coefficients from OLS models with standard errors clustered at the individual level. The dependent variable is the number of lies made by the PM in the Investment Game. Finally, the regressions in Table F5 report the estimates of coefficients from Probit models with standard errors clustered at the session level. The dependent variable is having lied at least once when observing 0 stars in the Investment Game. In the three tables, the independent variable is the number of efficient choices made in the Allocation Game.

Table F3: Predicting Having Lied At Least Once.

	Random Pairs	Fixed Pairs	Random Triplets	Fixed Triplets
Number of efficient choices	0.126 (0.134)	0.027 (0.025)	0.048 (0.084)	-0.143 (0.102)
Constant	-0.519 (1.585)	0.654 (0.322)	0.757 (1.188)	3.558 (1.552)**
Number of observations	42	39	78	78

Notes: This Table presents Probit regressions of having lied at least once on the number of efficient choices in the Allocation Game. Standard errors are clustered at the individual level. In the Fixed Pairs treatment, the independent variable is omitted as a number of efficient choices not equal to 8 predicts success perfectly - we therefore present the results of the OLS regression instead. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table F4: Predicting the Number of Lies.

Treatments	Random Pairs	Fixed Pairs	Random Triplets	Fixed Triplets
Number of efficient choices	0.860 (0.607)	-0.173 (0.400)	-0.058 (0.335)	0.071 (0.269)
Constant	3.300 (7.485)	10.254 (5.107)*	17.058 (4.907)***	7.934 (4.230)*
Number of observations	42	39	78	78
R^2	0.038	0.005	0.001	0.001

Notes: This Table presents OLS regressions of the number of lies a PM makes on the number of efficient choices in the Allocation Game. Standard errors are clustered at the individual level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table F5: Predicting Having Lied At Least Once When Observing 0 Stars.

Treatments	Random Pairs	Fixed Pairs	Random Triplets	Fixed Triplets
Number of efficient choices	0.048 (0.129)	-0.058 (0.118)	-0.044 (0.074)	0.093 (0.072)
Constant	0.146 (1.556)	0.986 (0.402)	1.421 (1.074)	-0.867 (1.050)
Number of of observations	38	37	75	76

Notes: This Table presents Probit regressions of having lied at least once when seeing 0 stars on the number of efficient choices in the Allocation Game. Standard errors are clustered at the individual level. Not all subjects observed 0 stars at least once, which explains the small difference in the number of observations with respect to the other regressions. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$